STUDIES ON PRESOWING SEED TREATMENTS IN DIFFERENTIALLY AGED SEEDS OF BRINJAL (*Solanum melongena*) cv. PKM 1

Thesis submitted in part fulfilment of requirements for the Degree of Master of Science(Agriculture) in Seed Technology to the Tamil Nadu Agricultural University Coimbatore

by

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CERTIFICATE

This is to certify that the thesis entitled "**STUDIES ON PRESOWING SEED TREATMENTS IN DIFFERENTIALLY AGED SEEDS OF BRINJAL (*Solanum melongena*) cv. PKM 1**" submitted in part fulfilment of the requirements for the degree of **MASTER OF SCIENCE (Agriculture) IN SEED TECHNOLOGY** to the Tamil Nadu Agricultural University, Coimbatore is a record of bonafide research work carried out by **KADASANI VISWANATHA REDDY** under my supervision and guidance and that no part of this thesis has been submitted for the award of any other degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journal or magazine.

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ABSTRACT

STUDIES ON THE PRESOWING SEED TREATMENTS IN DIFFERENTIALLY AGED SEEDS OF BRINJAL (**Solanum melongena** L.)cv. PKM 1

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Before going to test the efficacy of eco-friendly seed protectants such as Arappu, Acacia, Neem, Notchi and Pungam along with Vit E, $CaCl_2$, Hydration-dehydration and Captan on the brinjal seeds having differential vigour and viability, seed age was accelerated by adopting a technique called "ACCELERATED AGEING" recommended by Delouche (1965).

Based on the reduction in per cent germination, the aged seeds were grouped as mildly aged (A_1), moderately aged(A_2) and severely aged(A_3). The fresh and non aged (A_0) seeds were taken as control.

After giving pre-sowing seed treatments, the seed lots with differential vigour and viability were tested in the laboratory and field for all quality parameters viz., speed of germination, per cent germination, root and shoot length, vigour and dry matter production under laboratory conditions, speed of field emergence, per cent emergence, plant height and leaf area at 35^{th} day, flower number, fruit length, fruit diameter, fruit volume, fruit and seed yield, seed number, seed recovery and earliness index.

Among the treatments, Pungam and Arappu in non aged seeds, Vit E, Acacia and Notchi in differentially aged seeds improved the germination and other physiological potentials.

Seeds pelleted with Acacia, Neem, Notchi and Pungam equally performed with Vit E in fruit yield and seed yield.

Acacia, Vit E and $CaCl_2$ showed significant increase in seed number per fruit. The seed recovery of differentially aged seed progenies was ranged from 4.5 to 3.6 per cent.

Wider variation in per cent germination was observed between non-aged and severely aged seed progenies of resultant seed. Whereas, the differences were minimum between mildly and moderately aged seed progenies.

In an experiment conducted to study the performance of treated and untreated seeds at different water holding capacities in black and red soil revealed that water holding capacity of the soil have much influence on seed germination. When untreated seeds showed complete failure at 100 per cent water holding capacity in black soil, it was Vit E, Vit C and Pungam which could be able to over come chilling stress. All the pelleting and priming treatments were superior to untreated control at all water holding capacities in both black and red soil.

The experimental results showed that 40 to 60 per cent water holding capacity is the optimum for obtaining standard germination percentage under field conditions regardless of the soil type.

Studies on the influence of gamma radiation on the germination and other quality parameters revealed that pre-treatment with Vit C could able to arrest the adverse effects and yielded beneficial effects even at considerably higher doses of radiation.

Studies also revealed that a slight change in seed moisture content at the time of exposure to radiation would cause major adverse effects on seed germination and seedlings with abrupt root, thick cotyledonary leaves and also seedlings without any true leaf.

In experiment conducted to study the influence of gamma radiation on differentially aged seeds revealed that 10 Kr increased the germination per cent of mildly, moderately and severely aged seeds to an extent of 12, 16 and 14 per cent respectively.

Experimental results of magnetic treatment on differentially aged seeds revealed that prolonged magnetic treatment of 8 hours increased the germination of mildly, moderately and severely aged seeds.

Storage studies with pelleted seeds revealed that pre-sowing treatment with Vit E maintained well above the standard germination percentage even after 8 months of storage. Similarly, Arappu pelleted seeds showed acceptable vigour and viability even after 8 months of storage.

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INTRODUCTION

CHAPTER I

INTRODUCTION

Brinjal, otherwise called egg plant, **(Solanum melongena)** is a native of India. It is grown throughout the country except at higher altitudes.

It has now become widely distributed throughout the tropics. The main areas of cultivation include tropical Asia (India, China, Malaysia, Burma, Indonesia), tropical Africa (North Africa, Nigeria, Ghana, Kenya), tropical America (Puerto Rico, the West Indies) and throughout most tropical and sub-tropical areas (Chada, 1993).

Brinjal occupies an area of 4,32,000 ha in the world with the production of 5.54 million tons (FAO, 1987). In India, it occupies an area of 2,99,770 ha with the production of 31,24,487 tons (Gill and Tomer, 1991). In Tamil Nadu, it occupies an area of 6,879 ha with an annual production of 64,374 tons.

According to Choudhury (1979), the common belief that the food value of brinjal is low is not correct, its nutritive value being quite high and can well be compared with that of tomato. The vegetable is reported to contain 124 IU of Vit A, 0.14 mg of Vit B, 12 mg of Vit C and 1.4 g of protein per 100 g of edible fruit. It has some Ayurvedic medicinal properties viz., as appetiser, aphrodisiac, cardiotonic and beneficial in "Vata" and "Kaph" etc., and white brinjal is said to be good for diabetic patients. It has also been recommended as an excellent remedy for those suffering from liver complaints (Nandkarni, 1927).

No grower can be convinced of the merits of a new cultivar whatever may be the performance in comparative trials if the sown seeds do not produce the required population of plants necessary for yield and his market intentions. In many vegetable crops that are widely spaced, seed establishment is a crucial factor and has a significance well beyond an affect on yield.

Where crops are precision sown the delayed emergence of individual seeds will clearly affect uniformty at maturity as well as yield. Hence, the practice of sowing more than one seed per hill to guarantee a seedling at every hill following thinning. A level of quality in seeds that will give the confidence to growers to sow just one seed per hill would give cost savings.

Seed quality, or lack of it, is revealed not only by empty hills but by a spread in germination time leading to poor uniformity in seedling sizes in the transplants, the determining factor as far as uniformity in the eventual product is concerned. This also applies where seed is sown directly in the field; the late emergers produce seedlings that always lag behind the rest right up to harvest time (Mattews, 1994).

Seeds of field-sown crops are often exposed to adverse environmental conditions during germination, emergence, and seedling development. Several environmental and seed physiological factors interact with these growth stages and contribute to the relative success of crop production. Advances in seed priming, coating/pelleting, and various combinations of other presowing seed treatments show promise for improvement of crop stand establishment.

The need for reliable and uniform crop establishment in horticultural production systems is well recognized (Herner, 1986; Heydecker and Coolbear, 1977; Gray, 1 978). After many steps involved in seed production, harvesting, milling, and storage, the ultimate indicator of a seedlots' quality is its performance upon sowing in the field or green house. Factors that limit stand establishment include soil crusting, poor seed/soil contact, excessively high or low temperatures, seed-borne/soil-borne pathogens, and deficient or excessive soil moisture (Bennett **et al.**, **1992**).

Ageing is a universal physiological phenomenon occurring in living organisms. Ageing is one of the most intriguing and challenging scientific problems of universal concern (Moment, 1978). Consequently increasing number of biologists have become interested in research on the molecular, biochemical and physiological mechanism associated with ageing in animals and plants (Schneider, 1978; Kanungo, 1980 and Woolhouse, 1980).

Orthodox seeds of most of the horticultural crops deteriorate, though not as high as recalcitrant seeds, due to ageing making them poor planting material after the first year under normal storage conditions (Purkar et al., 1979; Purkar, 1980).

Further, the available storage technology, at present, is not safe and simple enough for adoption by a farmer to store his seed till the sowing season. Whereas, increasing cost of production and storage is a limiting factor to supply quality seeds.

Moreover, in agricultural practice, it is widely recognized that there is a gradual decline in the germinability of the seeds preceded by a loss of vigour which is expressed in lower growth rates of the resultant seedlings when aged seeds are planted.

In the increase utilization of atomic energy in many fields, the construction of atomic power stations is an inevitable need for any country in the modern age. Similarly like any other industry the atomic reacters are also subjected to breakage, leaking radiation of very harmful nature to biological materials as of such incident happened in Chernobyle in Russia.

Hence, it is the duty of seed scientists to find ways and means to protect the life of seed on any cost by seed treatments.

The fact that the magnetic energy can exercise some kind of influence on living things, plants etc., has attracted the scientists at different parts of the world. The effect of magnetic field in a biological system is through the existence of transient free radicals or via the paramagnetic substances present in the biological system. Experiments have demonstrated that the nature of pole, the magnetic intensity, as also duration of exposure can have differential influence (Bansal, 1982).

With the above views in mind, the following objectives were covered in the present investigation viz., tracing the pattern of seed deterioration in brinjal, testing the efficacy of plant products/chemicals in rejunavating the seeds having differential vigour and viability and also extending the shelf life under storage, testing the performance of treated and untreated seeds in different soil and water holding capacities, influence of gamma and magnetic treatment on seedling vigour and viability.

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

2.1 Physiological and biochemical changes during ageing

It was in the warm, humid conditions of Mississippi state that accelerated ageing as a test of storability was first suggested by Delouche (1965) initially for clover and grass seed but later extended to a range of crops (Delouche and Baskin, 1973). In the test seed lots are aged within an enclosed chamber over but not in contact with water at temperatures between 40 and 45°C for 48, 72 and 96 h depending on the species before being put through a germination test (Mattews, 1994).

Ageing involves the process of deterioration, that is, the accumulation of irreversible degenerative changes until eventually the ability to germinate is lost. Maximum seed quality occurs at physiological maturity after which both vigour and viability starts to decline (Delouche, 1980).

Leibovitz and Siegel (1980) stated indirect evidence for the role of free radicals in ageing has come from studies of naturally occurring antioxidants or tocopherol and the effect of antioxidant seed treatments. The lipophilic tocopherol present in seeds quench both superoxide and lipid peroxy radicals.

Priestley **et al.** (1980) measured tocopherol levels directly and found no change during accelerated ageing.

Woodstock and Taylorson (1981) proposed that ageing led to a breakdown between glycolysis and krebs' cycle leading to the prolonged accumulation of ethanol during the early stages of germination of low vigour seeds and increased respiratory quotient. Chromosomal damage is the final deteriorative change which is proposed to occur before loss of viability.

Dourado and Roberts (1984a) observed an increased in chromosome aberrations, mainly of the chromatid type, occurred even with a small decrease in the viability of barley and pea seeds. An increase in mutation frequency also occurred with a small fall in viability indicating that there is no threshold loss of viability which completely avoids mutation.

Powell and Mattews (1984b) recognized the reduced rates of germination and emergence, decreased tolerance to suboptimal conditions and poorer seedling growth as physiological symptoms of seed ageing in grain legumes. They also recognized the changes in solute leakage, enzyme activity, respiration and ATP content, protein and DNA synthesis, the chemical content of seeds and genetic changes.

2.2 pre sowing seed treatments

Seed pelleting/coatings

Longden (1975) described that although pelleting was adopted at first to make seed roundness to facilitate accurate precision sowing, it has also potential for accurate dosing of seeds with chemicals.

Kunelius and Gupta (1975) working with the **Medicago sativa** reported that survival of inoculum in dry soil was poor on unpelleted seed but better under the protection with a lime pellet.

Coatings play a role in regulating water uptake, which may be critical if testa or pericarp integrity is poor (Powell, 1978).

Keshwal (1981) reported that coating of surface sterilised seeds with culture of several species of micro organisms was antagonistic to damping off disease in tomato.

The germination of green gram was affected by neem cake pelleting, where as, neem oil delayed and suppressed germination (Vijayalakshmi and Goswami, 1986).

Ollerenshaw (1988) reported that adverse effect of excessive moisture were alleviated by coating with Calcium peroxide.

Taylor et al. (1991) employed seed pelleting technique to trap the sinapine leakage from seeds of Brassicaceae by coating with an absorbent pelgel 10 per cent. The coated seeds were dried and sorted into fluorescent and non-fluorescent categories using UV light. These seeds were germinated and the percentage of dead seeds, normal and abnormal seedlings were assessed. Non-fluorescent seeds produced the highest percentage of normal seedlings in each case.

Seed treatments

Dhesi and Gupta (1966) tested several growth substances in brinjal, but none improved the germination percentage, which was over 85% even in the control. IBA treatments reduced the germination percentage. In a test of various levels of GA (.01 to 1000 ppm) the higher doses reduced the germination percentage. All the chemicals increased the number of abnormal seedlings produced as compared with the control.

Contrary to the above statement, Sadawarte and Gupta (1968) observed increased percentage of germination when seeds treated with GA at a conc. of 5, 10, 20 and 40 ppm and IAA and NAA each at 5 and 10 ppm. P-CPA treatments produced the heaviest fruits and those with the fewest seeds.

Basu et al. (1975) reported that seeds of several plants, includes egg plants, soaked for 2-6 h in water and dried to original weight improved seed vigour and viability. Chemicals that were effective in improving vigour and viability includes sodium phosphate, sodium thiosulphate, oxalic acid, thiourea and urea.

El-Kadi et al. (1975) applied various 24 hour presoak treatments followed by drying to maize. 0.25% $CaCl_2$, 0.05% Zn SO_4 and 0.05% Mn SO_4 solutions all led to improved yields compared with just presoaking in distilled water both normal and water stress conditions.

Herner (1986) found encouraging results in tomato and pepper that the greatest seed treatment benefits often are seen for earlier plantings, when soils typically are cool and wet.

Xu and Gu (1987) observed the use of organic solvent acetone treatments enhanced seed germination of **Solanum melongena**.

Rudrapal and Nakamura (1988) highlighted the effect of hydration-dehydration pre treatments on egg plant and radish seed viability and vigour. Hydration of 6 month-old brinjal and radish seeds by soaking, dipping in water or moisture equilibrium with a water saturated atm. for 24-72 h, followed by drying back, greatly reduced the loss of vigour and viability of seeds subjected to accelerated and natural ageing conditions. The greater membrane integrity of treated seeds was indicated by the lower electrical conductance of seed leachates and reduced leakage of sugars. Higher activities of dehydrogenase enzymes and lower lipid peroxidation values in the treated seeds were also detected. It is suggested that the hydration-dehydration treatments extend the viability of the seeds by reducing free radical damage to cellular components.

2.3. Seed quality and stand establishment

Imbibitional chilling injury has been identified as major contributing factor to poor stand establishment in cold soils, particularly in tropical or subtropical vegetable crops (Lyons, 1973).

A non regulated rate of initial imbibition leads to solute leakage in to the surrounding medium, which not only weakens the vigour of the seed, but also creates a favorable environment for soil pathogen attack (Short and Lacy, 1976).

Priming involves the hydration of seeds in an osmotic solution that permits the preliminary process of germination, but not the final phase of radicle emergence (Heydecker and Coolbear, 1977).

According to Andrew (1982) factors like peicarp damage, maturity of seed at harvest, exposure to low temperature or frost during maturation, drying rate, age of seed and genetically inferior endosperm and embryo invariably affect the quality of seed.

A non regulated rate of imbibition due to one or more of the factors listed above has been associated with cell membrane disruption during the transition from the "hexagonal II phase" to the lipid bilayer phase (Herner, 1986).

Priming can increase crop uniformity by reducing the time needed for stand establishment and in minimizing the exposure for soil crusting, unfavorable temperatures and soil-borne diseases (Alvarado et al., 1987).

Bennett and Waters (1987a) used Vermiculite as media in solid matrix priming where it is non toxic, have high water holding capacity, remain at different moisture contents and easily separated from the seeds after priming.

Osmoconditioning differs from a moisturization technique called "hardening", which allows normal imbibition and is followed by dry-down period (Bennett et al., 1992).

2.4 Pre-sowing irradiation of seeds

Maxwell and Kampton (1939) were the pioneers on ionizing radiation work, reported the severe effect of X - rays on the germination of maize seeds.

Crocker and Barton (1955), while generalizing studies on the effect of X-rays on seed germination, came to the conclusion that irradiation of seeds may not have a favorable effect on germination and growth, but such a treatment could be advantageous for certain morphological and genetical studies.

Gordon and Weber (1955) believed that ionizing radiations may also cause inactivation of growth regulators in vivo and in vitro.

Gunckel and Sparrow (1961) viewed that pre-sowing irradiation of seeds may induce cytological, morphogenetical, biochemical and physiological changes in cells and tissues.

Ravindranath (1981) claimed to have varied and significant effects on the seed germination, growth and development in plants when seeds were subjected to ionizing radiations.

Inhibitory and stimulatory effects of gamma radiation

Haber and Luippold (1959) observed that 150 Kr prevented about half the viable lettuce seeds from germination.

Germination stimulation in banana seeds (**Musa balbisiana**) at 3,000 r to 9,000 r of gamma rays was reported by Stotzky **et al**.(1964).

Delayed germination as an effect of gamma irradiation was reported in the seeds of **Corchorus sp**. by Sen and Ghosh (1968).

Conger and Stevenson (1969) showed that heavily irradiated seeds may produce a small shoot but no roots, so that the seedlings die.

Fesenko and Tsarapkin (1973) observed that greater the amount of water in the irradiated seeds, more was the imbibition of germination in pea cv."Kapital".

Patel and Shah (1974), while studying the effect of Gamma irradiation (10,20 and 30 Kr) on **Solanum melongena** and **Capsicum annum**, reported retardation in seed germination and development of seedling.

Boshnakov (1975) reported that seed irradiation with 2000 r increased the earliness of the egg plant cv.

bulgarski 12 by 10.8% and the yield by 6.0%.

Delay in sprouting of irradiated bulbs (**Allium sativum**) have been reported by Choudhary and Dhyansagar (1980).

Tejeda (1986) showed the highest α - amylase activity and respiration rate when seeds of tomato cvs. Jibilee, K-262 and K-dwarf were subjected to gamma radiation doses of 5, 7.5, 10 and 50 Gy.

Nishiyama **et al.** (1990) investigated the effects of gamma irradiation in soybean where no true leaf developed when seeds treated with 0.5 or 0.7 kGy, although seedlings with cotyledons were alive.

For efficient mutagenesis in brinjal, Zeerak (1992) preferred radiations instead of chemicals as radiations induce low biological damage and also permit the use of high doses for higher efficiency and efficacy. Gamma rays proved quite efficacious in the production of useful mutants than EMS (Ethyl methanesulphonate) and combination treatments.

Proposed causes for inhibitory and stimulatory effects.

Errera (1955) suggested that chromosomes may be the primary site of damage in seeds and damage may be at the metabolic level before it effects morphology or growth.

Exposure to gamma radiation causes increased O_2 uptake (Sax, 1955) where placing of seeds in high O_2 concentration causes a reduction in the inhibitor level and thus promotes germination (Wareing and Foda, 1957).

Hay (1962) reported that H_2O_2 can break seed dormancy and as such the formation of organic and inorganic per oxide radicals due to irradiation may be responsible for promoting germination.

Kuzin (1964) assumed that the growth stimulation is a sequence of activation of enzymes and an enhancement of metabolism by suitable doses of irradiation. Thus, soaking of irradiated seeds in the presence of oxygen from the air, certain reactions take place that enhance the concentration of active oxidants.

Ovcharov (1964) suggested the possible enhancement in the activity of enzymes which in turn are associated with a new synthesis of vitamins after stimulatory doses of irradiation.

Sukach (1964a,b) established that the hydrolysis of starch and protein and an accumulation of amino acids and sugar in seedlings of maize increased when seeds are treated with gamma rays in a dose of 1600r.

Evans (1965) well described the effects of radiation as to affect plants largely due to mitotic arrest and inhibition of DNA syntheses in the meristematic areas.

Conger (1972) mentioned that pre and post irradiation seeds moisture content and O_2 level were the two main factors affecting radio-sensitivity of seeds. More over, according to him, there is a critical seed moisture content below and above which seeds are less sensitive. In addition oxygen in most species enhances damage induced by radiation and that the effect of moisture content is simply a secondary effect of oxygen. At certain moisture levels a small changes in moisture can cause large changes in radio-sensitivity.

Conger (1972) also pointed out that the most important factor is the volume of the nucleus in the cells of the terminal apex of the dormant embryo, so that the larger the nucleus the more radio-sensitive is the species.

Dhopte and More (1975) reported that gamma irradiation induced change in crude protein and Vit-C content of brinjal. The crude protein content of the fruit of three egg plant cultivars grown from seed treated with gamma rays at upto 60 K rad was altered by less than 1% by the treatments. However, the ascorbic acid content was increased by upto 56.91%, influenced cultivars of egg plant.

Ravindranath and Madan (1986) noticed increased female sex expression in cucurbits when seeds are exposed to low doses of 0.5 to 2.5 Kr gamma radiation and further reasoned that most probably gamma irradiation induces the ethylene evolution in plant tissue during growth and development ultimately this increased endogenous level of ethylene enhances the female sex expression ultimately the yield of plant.

2.6 Magnetic seed treatments

Kolla et al. (1974) subjected wheat seed to a magnetic field of 500 oersted for 15 min increased dry weight and decreased intensity of superweak irradiation of the etiolated seedlings and suggested that seed treatments in a magnetic field increases activity or amount of antioxidants in the lipid membrane of cells.

Recurrent rains after harvesting and before threshing wheat caused different levels of seed deterioration. The durum wheat cv. DWL 5023 was more resistant to grain wetting than soft wheat cv. seeds stored after drying and exposed to magnetic field before sowing showed a higher rate of germination and seedling establishment than untreated seeds. Responses of seeds to the treatment depended on the degree of their deterioration (Sekhon et al., 1985).

2.7. Seed storage

Kagramanyan (1971) postulated that during the ageing of crepis seed, mutagens of two types are produced, one with an undelayed type of action causing chromosomal aberrations and another with delayed action causing chromatic aberrations.

Storage of seeds, whether irradiated or not, leads to an increase in the number of chromosome aberrations and of mutations. The spontaneous rate is very low, but following irradiation the relative frequency of different types varies (McKelvie, 1977).

Treatments of onion, pepper and parsley seeds with several concentrations of tocopherol and butylated hydroxytoluene improved storability in some storage conditions but increased deterioration in others (Woodstock et al., 1983).

Sanpedro (1986) observed that temperature had better effect on the longevity of egg plant seeds stored over $CaCl_2$. Seeds when stored in the absence of a drying agent kept well for only 160 days; while those stored over calcium chloride showed deterioration after 312 days.

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

MATERIALS

Genetically true to type seeds of Brinjal cv. PKM 1 obtained from the Breeder Seed Increase Project, Agricultural Research Station, Bhavanisagar formed the basic material for the study.

3. METHODS

3.1. STUDIES ON THE PATTERN OF SEED DETERIORATION UNDER ACCELERATED AGEING CONDITION

Graded Seeds were subjected to accelerated ageing at a regime of 40 ± 1°C and 98 ± 2% RH (Delouche and Baskin, 1973). Seed samples were drawn at 2,4,6,8 10,12,14,16 and 18 days after ageing and the following tests were conducted to trace the pattern of deterioration. The non-aged seeds were taken as the control.

3.1.1. Speed of germination (Maguire, 1962)

The germination test was conducted by using sand medium in plastic containers of 20 x 20 x 5 cm in three replicates of 200 seeds each at 25 ± 2° C and 90 ± 2% RH. Countings were made daily on the number of seedlings emerging out of the sand with unfolded cotyledons. The speed of germination was calculated by using the following formula.

$$\text{Speed of germination} = \frac{X_1}{Y_1} + \frac{X_2 - X_1}{Y_2} \ldots\ldots + \frac{X_n-(X_n-1)}{Y_n}$$

where,

X_n - Number of seeds germinated at n th count

Y_n - Number of days from sowing to n th count

3.1.2. Germination (%) (Punjabi and Basu, 1982)

The germination test was conducted using inclined glass plate method. Three replicates of 25 seeds each were equally placed on a sterilised moist germination paper and allowed to germinate inside the germination room at 25 ± 2° C and 90 ± 2% RH . The seedlings were evaluated on 14th day. All the normal seedlings were counted and expressed as percentage of germination.

3.1.3. Root and shoot length (cm)

Ten normal seedlings from each replicate were selected at random and the root length was measured from the collar region to the tip of the root and the shoot length was measured from the collar region to the growing tip of meristem. The mean of ten seedlings was calculated and expressed in cm.

3.1.4. Vigour index (Abdul-Baki and Anderson, 1973)

The vigour index was calculated using the following formula and expressed in whole number.

VI = Germination percentage x mean seedling length in cm.

3.1.5. Dry matter production (mg)

All the normal seedlings were dried under shade for 12 h and then transferred to a hot air oven maintained at 105° C for 16 hours. The dried seedlings were cooled in a desiccator containing fused Calcium chloride and weighed. The dry matter production was expressed in mg. seedling $^{-1}$.

3.1.6. Electrical conductivity (Presley, 1958)

Three replicates of fifty seeds each from each sample were taken and washed with deionised water. Then the seeds were soaked in 20 ml of deionised water for 8 hours at room temperature.

The electrical conductivity of the seed leachate was measured in an Elico digital conductivity meter (Type MCD - 287) with an electrode possessing a cell constant of one. The electrical conductivity of seed leachate was expressed as dSm^{-1} per 50 seeds per 20 ml of water.

3.1.7. Protein content (Ali-Khan and Youngs, 1973)

Hundred mg of finely ground meal was taken in a 50 ml poly ethylene screw cap bottle and 25 ml of 1 N sodium hydroxide was added. The mixture was shaken for 30 minutes in a wrist action shaker to disperse the protein. Then ten ml of the suspension was poured into a graduated test tube and used as a blank to compensate for the differences in the amount of natural pigments extracted. To the remaining suspension in a screw cap bottle, 0.25 ml of 10% copper sulphate solution was added and the bottle was reshaken for an additional duration of 5 minutes to develop the colour complex. The sample solution was then poured into a separate test tube and left over night to allow the dispersed material to settle down. Then the sample solution was centrifuged for 10 minutes to obtain a clear supernatent solution. The optical density (O.D.) of the clear supernatent solution was measured in an ERMA photo electric colorimeter (Model AE -II) using a red filter 620 nm) with suitable blank. From the mean O.D value, the protein percentage for each treatment was calculated as follows.

Protein percentage = 3.73 + (61.6 x O.D. Value)

3.2. STUDIES ON THE INFLUENCE OF PELLETING TO IMPROVE THE SOWING QUALITY AND FIELD PERFORMANCE OF DIFFERENTIALLY AGED SEEDS OF BRINJAL cv. PKM 1

Seeds aged for 6, 10 and 14 days under accelerated ageing conditions and non aged seeds (control) were pelleted with leaf powders of different trees species. Their efficacy was evaluated through both lab and field tests.

3.2.1 Duration of ageing in a regime of 40 ± 1°C and 98 ± 2 % relative humidity

A0 - Non aged seeds (fresh seeds)

A1 - Aged for 6 days (mildly aged)

A2 - Aged for 10 days (moderately aged)

A3 - Aged for 14 days (severely aged).

3.2.2. Seed Treatments

T1 - Pelleted with leaf powder of Acacia (**Acacia nilotica** L.) @ 300 g. kg^{-1} of seed

T2 - Pelleted with leaf powder of Arappu (**Albizia amara** L.) @ 300 g. kg-$^{-1}$ of seed

T3 - Pelleted with leaf powder of Neem (**Azardirachta indica** L.) @ 300 g.Kg^{-1} of seed

T4 - Pelleted with leaf powder of Notchi (**Vitex negunda** L.) @ 300 g. Kg^{-1} of seed

T5 - Pelleted with leaf powder of Pungam (**Derris indica** L.) @ 300 g. Kg^{-1} of seed

T6 - Captan @ 2 g. Kg^{-1} of seed dry dressed

T7 - α - tocopherol 1% soaked for 3 h and driedback

T8 - $CaCl_2$ 1% soaked for 3 h and driedback

T9 - Hydrated for 3 h and dehydrated (H - DH)

T10 - Control (untreated seeds)

3.2.3. Method of pelleting

The leaves were collected, sun dried and powdered in a laboratory grinder. The powdered material were sieved through home sieve. The powder thus obtained was used for pelleting the seeds.

The seeds were uniformly wetted with adhesive (rice gruel @ 300 ml. kg^{-1}) in a hand operated pelletizer designed by TNAU and then the leaf powder was added. The pelletizer was rotated by hand till all the seeds were uniformly coated.

Preparation of Vit E 1% solution

To prepare one percent aqueous solution of Vit E (α - tocopherol), a few drops of acetone was added till it get completely dissolved. Then 40 ml of water (for 400 mg Cap) was added to prepare one per cent aqueous solution of Vit E.

3.2.4. Laboratory performance

3.2.4.1. Speed of germination as detailed under 3.1.1.

3.2.4.2. Germination as detailed under 3.1.2.

3.2.4.3. Root and Shoot length as detailed under 3.1.3.

3.2.4.4. Vigour index as detailed under 3.1.4.

3.2.4.5. Dry matter production as detailed under 3.1.5.

Treated and pelleted seeds were sown in the field directly and recommented package of practies for the seed crop was followed.

Design: FRBD

Repliation: Three

3.2.5. Field performance

3.2.5.1. Speed of field emergence

Observations were made daily on the number of seedlings emerged out of the soil with unfolded cotyledons. The speed of emergence was calculated by using the following formula.

$$\text{Speed of emergence} = \frac{X_1}{Y_1} + \frac{X_2 - X_1}{Y_2} \ldots\ldots + \frac{X_n - (X_n - 1)}{Y_n}$$

where,

X_n - Number of seeds germinated at n^{th} count

Y_n - Number of days from sowing to n^{th} count

3.2.5.2. Field emergence (%)

Number of seedlings emerged out of the soil in each treatment were counted on 14th day and expressed as percentage.

3.2.5.3. Plant height (cm)

The height of the plant was recorded in cm from the cotyledonary node to the growing tip of the plant at 35^{th} day after sowing.

3.2.5.4 Leaf area (cm^2)

Leaf area was measured in randomly selected five plants per plot at 35th day in a conveyor belt automatic leaf area meter (LI-COR Model 3100) and the mean was expressed in sq. cm.

3.2.5.5. Number of flowers

Five plants per plot were selected at random and the number of flowers were counted in all the five plants from the day of first flowering till the day of first harvest of fruits. The mean of five plants were taken and expressed as number of flowers per plant.

3.2.5.6. Fruit length (cm)

The mean length of the fruit was measured from ten randomly selected fruits per plot and expressed in cm.

3.2.5.7. Fruit diameter (cm)

The mean diameter of fruit was measured from the middle of ten randomly selected fruits per plot and expressed in cm (Joshi, 1963).

3.2.5.8. Fruit volume (cc)

The fruit volume was recorded by water displacement method. The individual fruits was immersed in a measuring cylinder containing water and the difference between initial and final reading was recorded and expressed as volume in CC.

3.2.5.9. Fruit yield (Kg. ha^{1})

Fruits harvested in plot wise and picking wise were weighed and the total weight of fruits from all the pickings were recorded as yield in Kg per plot and was computed to kg per hectare.

3.2.5.10. Seed yield (Kg. ha^{-1})

Seeds were extracted from all the fruits harvested plot wise picking wise and expressed as seed yield in Kg per plot and computed to Kg per hectare.

3.2.5.11. Seed number per fruit

Seeds extracted from five individual fruits per plot picking wise were counted and expressed as mean number of seed per fruit.

3.2.5.12. Seed recovery (%)

Seed recovery picking wise was worked out by using the formula and expressed as percentage of seed recovery.

$$\text{Seed recovery} = \frac{\text{Seed weight}}{\text{Fruit weight}} \times 100$$

3.2.5.13. Earliness index for seed yield

$$\frac{X_1}{n_1} + \frac{X_2}{n_2} \ldots\ldots + \frac{X_n}{n}$$

where,

X = seed yield per plot per picking

n = duration of crop in weeks from date of planting

3.2.6. Laboratory evaluation of resultant seeds

3.2.6.1. Germination as detailed under 3.1.2.

3.2.6.2. Vigour index as detailed under 3.1.4.

3.3. INFLUENCE OF WATER HOLDING CAPACITY AND SEED TREATMENT ON GERMINATION AND SEEDLING VIGOUR OF BRINJAL cv. PKM1 IN DIFFERENT SOILS

3.3.1. Soils

S_1 - Black Soil

S_2 - Red soil

3.3.2. Water holding capacity

W_1 - 30%

W_2 - 40%

W_3 - 60%

W_4 - 80

W_5 - 100%

3.3.3. Estimation of water holding capacity

Typical Black and Red soils were collected and sieved through 2mm sieve. Soil were taken in a separate steel trays of 20 x 20 x 5 cm dimensions. The trays with the soil were initially weighed on a sensitive platform balance and the weight was recorded. Then a known quantity of water was added till the media reached saturated water holding capacity and weighed again. The difference in weight was taken as the total quantity of water required to reach 100% water holding capacity. To create 80, 60, 40, and 30% water holding capacity respective quantity of water was added and maintained throughout the germination period.

3.3.4. Treatments

T_1 - Pelleted with leaf powder of Acacia (**Acacia nilotica** L) @ 300 g. kg^{-1} of seed

T_2 - Pelleted with leaf powder of Arappu (**Albizia amara** L) @ 300 g. kg^{-1} of seed

T_3 - Pelleted with leaf powder of Neem (**Azardirachta indica** L) @ 300 g. kg^{-1} of seed

T_4 - Pelleted with leaf powder of Notchi (**Vitex negunda** L) @ 300 g. kg^{-1} of seed

T_5 - Pelleted with leaf powder of Pungam (**Derris indica** L) @ 300 g. kg^{-1} of seed

T_6 - Vit C (Ascorbic acid) 1% soaked for 3 hours and dried back

T_7 - Vit E(α-tocopherol) 1% soaked for 3 hours and dried back

T_8 - Hydrated for 3 hours and dried back (H-DH)

T_0 - Control (Untreated)

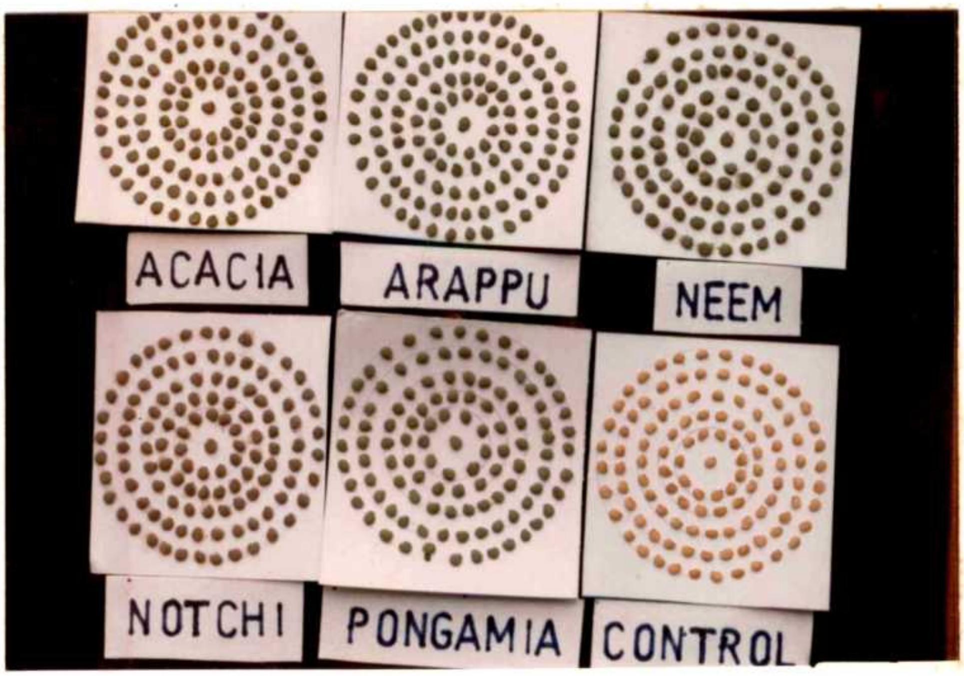


PLATE 1a. Brinjal seeds pelleted with leaf powder of acacia, arappu, neem, notchi, pungam and unpelleted control

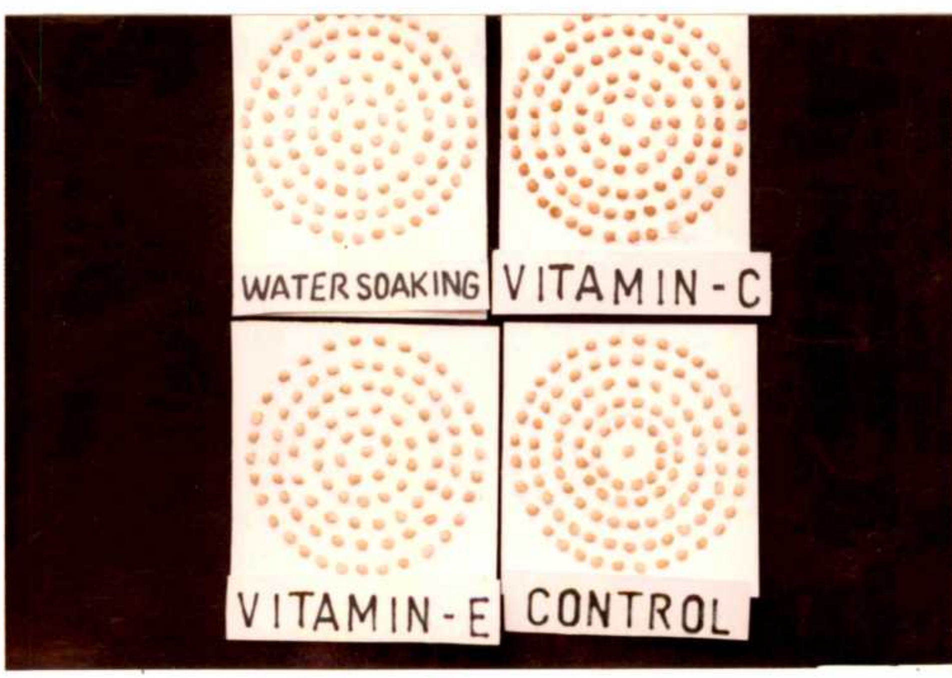


PLATE 1b. Brinjal seeds primed with Vit C, Vit E, Water and untreated control

3.3.5. Observations recorded

3.3.5.1. Speed of germination as detailed in 3.1.1.

3.3.5.2. Germination (%)

The standard laboratory germination test was conducted using different soils with different water holding capacities at 25 ± 2°C and 90 ± 2% relative humidity in three replicates of 50 seeds each. At the end of 14th day the number of normal seedlings were counted and expressed as percentage germination.

3.3.5.3. Root and shoot length as detailed under 3.1.3

3.3.5.4. Vigour index as detailed under 3.1.4.

3.3.5.5. Dry matter production as detailed under 3.1.5.

3.4. INFLUENCE OF GAMMA RADIATION ON THE QUALITY OF BRINJAL SEED cv. PKM 1

3.4.1. Seed treatment

T_1 - soaked in water for 3 h and dried back

T_2 - soaked in Vit C 1% for 3 h and dried back

T_0 - control (untreated)

Treated seeds of Brinjal cv. PKM 1 with uniform moisture content were subjected to different doses of gamma radiation from ^{60}CO source gamma chamber.

3.4.2. Doses of Gamma radiation

10 Kr - exposed to 64.8 seconds

20 Kr - exposed to 129.6 seconds

30 Kr - exposed to 194.4 seconds

0 Kr - Control

3.4.3. Observations recorded

3.4.3.1. Speed of germination as detailed under 3.1.1.

3.4.3.2. Germination as detailed under 3.1.2.

3.4.3.3. Root and Shoot length as detailed under 3.1.3.

3.4.3.4. Vigour index as detailed under 3.1.4.

3.4.3.5. Dry matter production as detailed under 3.1.5.

3.5. EFFECT OF GAMMA RADICATION IN CONTROLLING THE AGEING PROCESS IN BRINJAL cv PKM-1

3.5.1. Duration of ageing as detailed under 3.2.1.

3.5.2. Doses of Gamma Radiation as detailed under 3.4.1.

3.5.3. Observations recorded

3.5.3.1. Speed of germination as detailed under 3.1.1.

3.5.3.2. Germination as detailed under 3.1.2.

3.5.3.3 Root and Shoot length as detailed under 3.1.3.

3.5.3.4. Vigour index as detailed under 3.1.4.

3.5.3.5. Dry matter production as detailed under 3.1.5.

3.6. EFFECT OF MAGNETIC SEED TREATMENT ON DIFFERENTIALLY AGED SEEDS OF BRINJAL cv. PKM 1

Graded seeds were subjected to differential ageing before exposing to the magnetic field. Seeds were exposed to magnetic field of 400 gauge strength for different durations.

3.6.1. Duration of ageing as detailed under 3.2.1.

3.6.2 Duration of magnetic treatment

M_1 - Seeds exposed for 2 hours

M_2 - Seeds exposed for 4 hours

M_3 - Seeds exposed for 8 hours

M_0 - Control

3.6.3. **Observations recorded**

3.6.3.1. Speed of germination as detailed under 3.1.1.

3.6.3.2. Germination as detailed under 3.1.2.

3.6.3.3. Root and Shoot length as detailed under 3.1.3.

3.6.3.4. Vigour index as detailed under 3.1.4.

3.6.3.5. Dry matter production as detailed under 3.1.5.

3.7. STORAGE STUDIES WITH PELLETED SEEDS IN BRINJAL cv. PKM-1

The seeds were pelleted with different leaf powders using rice gruel as adhesive. The pelleted and treated seeds were stored in paper bags under ambient conditions. Samples were drawn at bi-monthly intervals and analysed.

3.7.1. **Treatments**

T_1 - Pelleted with leaf powder of Acacia (**Acacia nilotica** L.) @ 300 g. kg^{-1} of seed

T_2 - Pelleted with leaf powder of Ararappu (**Albizia amara** L.) @ 300 g. kg^{-1} of seed

T_3 - Pelleted with leaf powder of Neem (**Azardirachta indica** L.) @ 300 g.Kg^{-1} of seed

T_4 - Pelleted with leaf powder of Notchi (**Vitex negunda** L.) @ 300 g. Kg^{-1} of seed

T_5 - Pelleted with leaf of powder of Pungam (**Derris indica** L.) @ 300 g. Kg^{-1} of seed

T_6 - Dry dressing with Captan Thiram @ 2 g. Kg^{-1} of seed

T_7 - Soaking in Vit E (α-tocopherol) 1% for3 h and dried back

T_8 - Control

3.7.2. Period of storage

P_0 - Initial

P_1 - Two months after storage

P_2 - Four months after storage

P_3 - Six months after storage

P_4 - Eight months after storage

3.7.3. Observation recorded

3.7.4.1. Speed of germination as detailed under3.1.1.

3.7.4.2. Germination as as detailed under 3.1.2.

3.7.4.3. Root and Shoot length as detailed under 3.1.3.

3.7.4.4. Vigour index as detailed under 3.1.4.

STATISTICAL COMPUTATION

All the experiments carried out under laboratory conditions were statistically analysed under CRD and the field experiment was analysed under FRBD (Panse and Sukhatme, 1967). The data recorded in percentage were transformed to Arcsine for analysis purpose wherever necessary.

The critical differences (C.D.) were calculated at 5 per cent probability level and the non significant value was denoted by NS.

RESULTS

CHAPTER IV

RESULTS

4.1 Studies on the pattern of seed deterioration under accelerated ageing condition in Brinjal cv. PKM 1

The results were significant for almost all parameters such as germination, speed of germination, root length shoot length, vigour index, dry matter production, electrical conductivity and protein (Table 1).

4.1.1. Speed of germination

Seeds with an initial speed of germination of 6.5 lost 23 per cent of its vigour in about 12 days where as with in another 4 days 42 per cent of the initial vigour was lost. The seed lot lost its complete vigour in terms of speed of germination in 18 days of accelerated ageing.

4.1.2 Germination (%)

The seeds with an initial germination of 89 per cent lost about 25, 50 and 70 per cent in about 6, 10 and 16 days of accelerated ageing and it lost its complete viability within 18 days of accelerated ageing. The rate of deterioration is faster after 10 days of accelerated ageing.

4.1.3 Root and Shoot length (cm)

The initial root and shoot length were 4.55 and 6.00 cm respectively. The root length showed 9 % reduction in its length within 14 days of accelerated ageing. However, with in another 2 days the root length was reduced to 13 per cent. The shoot with an initial length of 6.0 cm lost about

Table 1. The pattern of seed deterioration under accelerated ageing condition in brinjal cv. PKM 1

Days after Accelerated ageing (A)	Speed of germination	Germination % (Arcsine)	Root length (cm)	Shoot length (cm)	Vigour index	Dry matter production (mg)	Electrical conductivity (dSm^{-1})	Protein content (%)
A_0	6.53	89 (70.63)	4.55	6.00	939	1.25	0.062	14.52
A_2	6.94	87 (68.87)	4.65	6.10	935	1.23	0.064	14.46
A_4	6.30	78 (62.03)	4.57	6.00	824	1.20	0.071	14.38
A_6	6.22	67 (54.94)	4.53	5.90	699	1.18	0.085	14.31
A_8	5.80	56 (48.45)	4.38	5.85	572	1.13	0.101	14.10
A_{10}	5.55	45 (42.13)	4.25	5.56	440	1.10	0.115	14.02
A_{12}	5.06	36 (36.87)	4.23	4.95	330	1.05	0.122	13.84
A_{14}	4.50	26 (30.66)	4.13	4.76	231	0.92	0.128	13.72
A_{16}	3.8	18 (25.10)	3.95	4.65	155	0.78	0.137	13.50
A_{18}	-	00 (0.00)	-	-	-	-	-	-
SE $\bar{d}$	0.08	1.75	0.28	0.054	14.1	0.047	0.054	0.14
CD(P=0.05)	0.16	3.94	0.06	0.11	29.5	0.10	0.11	0.29

Figures in paranthesis are arcsine tranformed values

7 per cent of its length within 10 days of ageing and within another 6 days the shoot length was reduced to about 23 per cent. The deterioration of shoot length was found faster than the root length in brinjal.

4.1.4 Vigour index

The vigour index was 939 and 155 in the initial and after 16 days of accelerated ageing respectively with a reduction of 85 per cent. Within 8 days of ageing the vigour index was reduced to 40 per cent. The loss of vigour index was faster in the later half than in the earlier half of ageing.

4.1.5 Dry matter production (mg)

The deterioration in seedling dry weight was gradual upto 12 days of ageing recording only 16 per cent reduction. However within another 4 days there was complete loss of dry matter production indicating that the ageing is faster in the later half than in the earlier half.

4.1.6 Electrical conductivity (dSm^{-1})

The loss in seed coat integrity, due to accelerated ageing as measured through electrical conductivity, was about 37 per cent after 6 days of accelerated ageing. During the later 10 days of accelerated ageing, larger leakage of electrolytes of about 121 per cent was observed over the fresh and non aged seed indicating heavy loss of seed coat integrity in later part than earlier part of accelerated ageing.

4.1.7 Protein content (%)

The sequential reduction in per cent seed protein due to accelerated ageing was slow recording only 7 per cent loss after 16 days of accelerated ageing.

4.2. Effect of pre sowing treatments to improve the quality of differentially aged seeds of Brinjal cv. PKM 1

4.2.1. Laboratory performance

The results were significant for almost all parameters such as speed of germination, germination percentage, root length, shoot length, vigour index and dry matter production for both ageing and treatments and their interactions.

4.2.1.1. Speed of germination (Table 2)

The moderately (A_2) and severely (A_3) aged untreated seeds recorded 16 and 76 per cent reduction in the speed of germination over the control. However, the mildly (A_1) aged seeds recorded a small increase of four per cent in the speed of germination over the control.

Among the treatments, only Vit E and Hy-dehydration treatments recorded 11 and 13 per cent increased speed of germination respectively over the control. Among the treatments, Captan, Vit E, $CaCl_2$ and hy-dehydration treatments improved the speed of germination of mildly (A_1) aged seeds to an extent of 38, 44, 33 and 66 per cent respectively than the respective control. Where as Vit E, Pungam, $CaCl_2$ and Hy-dehydration treatments increased speed of germination of moderately (A_2) aged seeds to an extent of 50, 18, 48 and 62 per cent over the respective control.

However, almost all treatments except Acacia, Arappu and Neem pelleted seeds increased the speed of

Table 2. Effect of pre-sowing seed treatments on the speed of germination of differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	5.92	4.47	2.38	4.25	4.82
Arappu	9.62	6.71	2.72	6.35	8.51
Neem	6.59	4.87	1.36	4.27	5.34
Notchi	7.12	5.37	5.12	5.87	7.62
Pungam	9.76	8.85	4.12	7.57	9.25
Captan	12.77	8.16	6.16	9.03	9.59
Vit E	13.31	11.27	7.24	10.60	9.82
$CaCl_2$	12.31	11.10	5.58	9.66	9.12
H-DH	15.23	12.15	7.04	11.47	10.05
Mean	10.29	8.10	4.63	7.67	7.14
Control	9.22	7.49	2.11	6.26	8.87

	T	A	TxA
SE $\bar{d}$	0.199	0.126	0.39
CD (P=0.05)	0.40	0.25	0.80

germination of severely (A_3) aged seed from 43 to 95 per cent over respective control. The maximum being recorded by Vit E followed by Hy-dehydration, Captan, $CaCl_2$ and Pungam treatment.

4.2.1.2 Germination (%) (Table 3)

The mildly (A_1), moderately (A_2) and severely (A_3) aged seed recorded 6, 16 and 48 per cent reduction in germination with in a period of 6, 10 and 14 days respectively over the control.

Among the treatments, Arappu, Pungam, Vit E and Hy-dehydration treatments improved the germination of non-aged (A_0) seeds to an extent of 14, 5, 6 and 4 per cent respectively over the control. The treatments Captan and $CaCl_2$ were on par and Acacia, Neem and Notchi recorded significantly lesser germination per cent than the control.

The germination percentage of mildly (A_1) aged seeds were improved by Arappu (12%), Pungam (4%), Captan (5%), Vit E (9%), $CaCl_2$ (12%) and Hy-dehydration (14%) over the control. Whereas, the germination percentage of moderately (A_2) aged seeds were improved only by Pungam (6%), Captan (12%), Vit E (28), $CaCl_2$ (20%) and Hy-dehydration (20%) treatments over the control. However, the germination percentage of severely (A_3) aged seeds were improved by Notchi (21%), Pungam (17%), Captan (30%), Vit E (38%), $CaCl_2$ (33%) and Hy-dehydration (34%) over the control.

Among all the treatments, Vit E recorded the highest increase in the germination percentage of all the three differentially aged seeds.

Table 3. Effect of pre-sowing seed treatments on the germination (%) of differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	46.0 (42.71)	38.0 (38.06)	15.0 (22.79)	33.0 (35.06)	49.0 (44.43)
Arappu	77.0 (61.34)	47.0 (43.28)	19.0 (25.84)	47.6 (43.62)	85.0 (67.21)
Neem	54.0 (47.29)	39.0 (38.65)	15.0 (22.79)	36.0 (36.87)	58.0 (49.60)
Notchi	57.0 (49.02)	43.0 (40.98)	41.0 (39.82)	47.0 (43.28)	61.0 (51.35)
Pungam	69.0 (56.17)	51.0 (45.57)	37.0 (37.46)	52.3 (46.32)	75.0 (60.00)
Captan	70.0 (56.79)	57.0 (49.02)	30.0 (33.21)	52.3 (52.30)	73.0 (58.69)
Vit E	74.0 (59.34)	73.0 (58.69)	58.0 (49.60)	68.3 (55.73)	77.0 (61.34)
$CaCl_2$	77.0 (61.34)	65.0 (53.73)	53.0 (46.72)	65.0 (53.73)	73.0 (58.69)
H-DH	79.0 (62.73)	65.0 (53.73)	54.0 (47.29)	66.0 (54.33)	75.0 (60.00)
Mean	67.0 (54.94)	53.1 (46.78)	35.8 (36.75)	51.9 (46.09)	69.5 (56.48)
Control	65.0 (53.73)	45.0 (42.13)	20.0 (26.57)	43.3 (41.15)	71.0 (57.42)

	T	A	TxA
SE $\bar{d}$	0.57	0.36	1.14
CD (P=0.05)	1.15	0.73	2.30

Figures in paranthesis are arcsine transformed values

4.2.1.3 Root and shoot length (cm) (Table 4 and 5)

The root length was reduced to an extent of 12 and 23 per cent in the moderately (A_2) and severely (A_3) aged seed progenies over the control. There was no significant reduction in the root length of mildly (A_1) aged seed progenies. Among the treatments, Notchi, Vit E, $CaCl_2$ and Hy -dehydration treatments increased the root length of non-aged (A_0) seed progenies over the control and the rest of the treatments failed to improve the length of root of non-aged (A_0) seed progenies.

Except Notchi (7%) no other treatment increased the root length of mildly (A_1) aged seed progenies.

Whereas, Notchi, Pungam, Vit E and $CaCl_2$ treatments increased the root length of the moderately (A_2) aged seed progenies to an extent of 8 to 12 per cent over the control.

So far as severely (A_3) aged seed progenies are concerned Pungam, Notchi, Vit E, $CaCl_2$, Arappu and Hy-dehydration treatments increased to root length to an extent of 9 to 21 per cent. Among all the treatments, seeds pelleted with Notchi increased the root length of both non-aged and differentially aged seed progenies in Brinjal.

The shoot length was affected to an extent of 13 and 20 per cent in the moderately (A_2) and severely (A_3) aged seed progenies respectively. There was no significant reduction in shoot length of mildly (A_1) aged seed progenies.

Among the treatments, the shoot length of non aged and differentially aged seed progenies were increased by

Table 4. **Effect of pre-sowing seed treatments on the root length (cm) of differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	4.32	4.19	3.50	4.00	4.45
Arappu	4.16	3.99	3.65	3.93	4.17
Neem	4.24	4.16	3.20	3.86	4.28
Notchi	4.65	4.35	3.98	4.32	4.74
Pungam	4.36	4.25	4.10	4.23	4.54
Captan	4.10	4.04	3.46	3.86	4.23
Vit E	4.50	4.20	3.90	4.20	4.90
$CaCl_2$	4.55	4.26	3.95	4.25	4.93
H-DH	4.24	3.91	3.69	4.03	4.87
Mean	4.35	4.15	3.71	4.07	4.56
Control	4.34	3.88	3.69	3.87	4.43

	T	A	TxA
SE $\bar{d}$	0.035	0.02	0.64
CD (P=0.05)	0.07	0.04	0.13

Table 5. Effect of pre-sowing seed treatments on the shoot length (cm) of differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	5.61	5.03	4.75	5.13	5.62
Arappu	5.30	5.20	4.65	5.05	5.41
Neem	5.38	5.28	4.22	4.96	5.74
Notchi	5.87	5.65	5.27	5.59	5.98
Pungam	5.92	5.70	5.55	5.72	6.02
Captan	5.45	5.20	5.00	5.22	5.48
Vit E	5.51	5.38	5.35	5.41	5.77
$CaCl_2$	5.31	5.30	5.08	5.23	5.44
H-DH	5.36	5.23	5.21	5.26	5.76
Mean	5.52	5.33	5.01	5.28	5.69
Control	5.22	4.58	4.20	5.12	5.27

	T	A	TxA
SE $\bar{d}$	0.036	0.02	0.06
CD (P=0.05)	0.07	0.04	0.13

almost all the seed treatments to an extent of 3 to 24 per cent. However, the maximum being recorded by Pungam seed pelleting and Vit E seed treatment.

Among all the treatments, only Pungam and Vit E treatment consistently increased the shoot length of the non aged and differentially aged seed progenies.

4.2.1.4. Vigour index (Table 6)

There was a reduction of 10, 44 and 78 per cent in the vigour index of mildly (A_1), moderately (A_2) and severely (A_3) aged seeds over the control.

Among the seed treatments, except Notchi, no other treatment improved the vigour index of non aged (A1) seeds to an extent of 23 per cent. Among the treatments Arappu, Pungam, Captan, Vit E, $CaCl_2$ and Hy-dehydration treatment of mildly (A_2) aged seeds increased the vigour index from 8 to 22 per cent over the respective control.

Whereas, the treatments Arappu, Notchi, Pungam, Captan, Vit E, $CaCl_2$ and Hy-dehydration increased the vigour index of moderately (A_2) aged seeds to an extent of 13 to 83 per cent. The maximum being recorded by Vit E treatment over the control. However, almost all the treatments except Acacia and Neem increased the vigour index of severely (A_3) aged seeds over the respective control to an extent of 67 to 240 per cent. The maximum being recorded by Vit E.

4.2.1.5. Dry matter production (mg) (Table 7)

Mildly (A_2),moderately (A_2) and severely (A_3) aged seed progenies recorded 6, 17 and 26 per cent reduction in the dry matter production than the non aged control.

Table 6. **Effect of pre-sowing seed treatments on the vigour index of differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	457	350	123	310.0	493
Arappu	728	431	157	438.6	814
Neem	519	368	111	332.6	581
Notchi	600	430	379	469.6	654
Pungam	709	507	357	524.3	792
Captan	668	526	254	482.6	709
Vit E	771	699	536	668.6	822
$CaCl_2$	759	621	479	619.6	757
H-DH	758	594	480	610.6	797
Mean	663.0	502.8	319.5	492.6	712
Control	621	380	152	384.3	689

	T	A	TxA
SE $\bar{d}$	10.99	6.95	22.0
CD (P=0.05)	22.2	14.00	44.0

Table 7. Effect of pre-sowing seed treatments on the dry matter production (mg) of differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	1.20	1.11	1.01	1.10	1.22
Arappu	1.07	1.03	1.01	1.03	1.14
Neem	1.19	1.09	1.04	1.10	1.22
Notchi	1.00	0.92	0.91	0.94	1.02
Pungam	1.31	1.24	1.07	1.20	1.36
Captan	0.97	0.91	0.87	0.91	1.10
Vit E	1.21	1.17	1.04	1.14	1.31
$CaCl_2$	1.03	1.02	0.91	0.98	1.09
H-DH	0.99	0.96	0.86	0.94	1.12
Mean	1.10	1.05	0.97	1.04	1.18
Control	1.02	0.90	0.80	0.91	1.08

	T	A	TxA
SE $\bar{d}$	0.015	0.011	0.032
CD (P=0.05)	0.03	0.02	0.06

Among the treatments, Acacia, Arappu, Pungam and Vit E treatment consistently increased the dry matter production of both non aged and differentially aged seeds significantly over the control. However, among the above said treatments, Pungam pelleting was found to be superior to all other treatments recording an increase in dry matter production of mildly (A_1), moderately (A_2) and severely (A_3) aged seeds to an extent of 32, 27 and 24 per cent respectively followed by Vit E seed treatment over the control.

4.2.2. Field performance

The results obtained were significant for ageing, treatment, and their interaction for speed of field emergence, field emergence percentage, plant height,leaf area, flower number, fruit length, fruit diameter, fruit volume, fruit yield, seed yield, seed number per fruit, seed recovery and earliness index.

4.2.2.1. Speed of field emergence (Table 8)

There was no significant reduction in the speed of field emergence of mildly (A_1) aged seeds. However, the speed of field emergence of moderately (A_2) and severely (A_3) aged seeds recorded a reduction of 24 and 76 per cent respetively.

Among the treatments, Notchi, Pungam, Captan, Vit E, $CaCl_2$ and hy-dehydration treatments increased the speed of field emergence of non aged seeds from 3 to 64 per cent over the control.

Among the treatments, Notchi, Vit E, $CaCl_2$ and Hy-

Table 8. Effect of pre-sowing seed treatments on the speed of field emergence of differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	3.37	3.03	1.55	2.65	6.29
Arappu	4.65	3.10	1.74	3.16	6.28
Neem	2.92	1.86	1.54	2.10	4.46
Notchi	7.80	7.40	3.22	6.14	10.24
Pungam	5.85	5.75	3.03	4.87	6.55
Captan	6.18	5.65	2.85	4.89	6.79
Vit E	7.05	6.50	3.71	5.75	7.25
$CaCl_2$	6.80	6.45	5.55	6.26	7.10
H-DH	7.28	7.19	2.28	5.58	8.69
Mean	5.76	5.21	2.83	4.60	7.07
Control	6.22	4.72	1.50	3.81	6.25

	T	A	TxA
SE $\bar{d}$	0.035	0.02	0.07
CD (P=0.05)	0.07	0.04	0.14

dehydration treatment increased the speed of field emergence to an extent of 12 to 25 per cent in mildly (A_1) aged seeds. Whereas, Notchi, Pungam, Captan, Vit E, $CaCl_2$ and Hy-dehydration increased the speed of field emergence to an extent of 22 to 57 per cent and 90 to 270 per cent in moderately (A_2) and severely (A_3) aged seeds respectively over their control.

Among the treatments, Vit E, $CaCl_2$ and Hy-dehydration treatments improved the speed of field emergence of almost all differentially aged and non aged seed progenies.

4.2.2.2. Field emergence (%) (Table 9)

There was a reduction of about 20, 42 and 72 per cent in the field emergence of mildly (A_1), moderately (A_2) and severely (A_3) aged seed over the non aged (A_0) control respectively. All the treatments except Captan,increased the field emergence of non aged seeds to an extent of 2 to 29 per cent. Maximum being recorded by Notchi. The field emergence of the differentially aged seeds were increased by almost all the treatments to an extent of 5 to 28 (A_1), 17 to 31 (A_2) and 5 to 15 (A_3) per cent respectively over the control.

Among the treatments, Notchi increased the field emergence of non aged and differentially aged seeds far better than the rest of the treatments.

4.2.2.3. Plant height (cm) (Table 10)

Mildly (A_1), moderately (A_2) and severely (A_3) aged seeds recorded reduction of 15, 18 and 39 per cent

Table 9. **Effect of pre-sowing seed treatments on the field emergence (%) of differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	45.0 (42.13)	36.0 (36.87)	27.0 (31.31)	36.0 (36.87)	64.0 (53.13)
Arappu	49.0 (44.43)	34.0 (35.67)	19.0 (25.84)	34.0 (35.67)	56.0 (48.15)
Neem	41.0 (39.82)	26.0 (30.66)	20.0 (26.57)	29.0 (32.58)	58.0 (49.60)
Notchi	68.0 (55.55)	60.0 (50.77)	29.0 (32.58)	52.3 (46.32)	79.3 (62.73)
Pungam	65.0 (53.73)	53.0 (46.72)	24.0 (29.33)	47.3 (43.45)	62.0 (51.94)
Captan	59.0 (50.18)	53.0 (46.72)	20.0 (26.57)	44.0 (41.55)	50.0 (45.00)
Vit E	61.0 (51.35)	57.0 (49.02)	26.0 (30.66)	48.0 (43.85)	56.0 (48.15)
$CaCl_2$	59.0 (50.18)	50.0 (45.00)	23.0 (28.66)	44.0 (41.55)	54.0 (47.29)
H-DH	57.0 (49.02)	45.0 (42.13)	16.0 (23.58)	39.3 (38.82)	63.0 (52.54)
Mean	56.0 (48.45)	46.0 (42.71)	22.6 (28.39)	41.5 (40.11)	59.7 (50.59)
Control	40.0 (39.23)	29.0 (32.58)	14.0 (21.97)	27.7 (31.82)	50.0 (45.00)

	T	A	TxA
SE $\bar{d}$	0.71	0.45	1.415
CD (P=0.05)	1.43	0.90	2.86

Figures in parantheses are arcsine transformed values.

Table 10. **Effect of pre-sowing seed treatments on the plant height (cm) of differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	14.30	12.07	10.09	12.15	17.40
Arappu	15.37	14.66	12.08	14.04	18.10
Neem	15.35	13.80	11.09	13.41	15.80
Notchi	17.34	17.30	13.67	16.10	18.79
Pungam	18.24	13.54	11.85	14.54	18.86
Captan	16.18	15.05	9.93	13.72	18.36
Vit E	18.76	18.43	14.04	16.41	20.73
$CaCl_2$	15.76	15.36	10.66	13.92	17.16
H-DH	13.56	13.28	11.02	12.62	17.84
Mean	16.09	14.83	11.38	14.10	18.11
Control	13.49	13.06	9.73	12.09	15.90

	T	A	TxA
SE $\bar{d}$	0.11	0.07	0.271
CD (P=0.05)	0.22	0.14	0.53

over the respective control.

All the treatments except Neem, increased the plant height to an extent of 8 to 30 per cent over the non aged control. However, maximum being recorded by Vit E (20.73 cm) followed by Pungam (18.86 cm) and Notchi (18.79 cm). Among the differential ageing (A_1, A_2 and A_3), Vit E (16.41 cm) followed by Notchi (16.10 cm) recorded highest on 35^{th} day after sowing.

4.2.2.4. Leaf area (cm^2) (Table 11)

There was a reduction in the leaf area of mildly (A_1), moderately (A_2) and severely (A_3) aged seeds to an extent of 13, 16 and 19 per cent over the non aged (A_0) control respectively.

Among the treatments, Arappu, Vit E and Captan treatments increased the leaf area of non aged seeds to an extent of 60, 30 and 28 per cent over the control. However, Notchi, Pungam, Captan and Vit E increased the leaf area of mildly (A_1) aged seed progenies to an extent of 55, 44, 42 and 49 per cent respectively over the control. In moderately (A_2) aged seeds, Arappu, Pungam, and Vit E increased the leaf area to an extent of 31, 37 and 48 per cent respectively over the control. Contrary to the above, Vit E seed treatment alone increased the leaf area of severely (A_3) aged seeds by 39 per cent over the control. Among all the treatments it was the Vit E alone increased the leaf area of both non aged and differentially aged seed progenies consistently.

Table 11. Effect of pre-sowing seed treatments on the leaf area (cm^2) of differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	31.83	22.31	19.62	24.58	31.61
Arappu	37.04	35.27	24.96	32.33	51.31
Neem	21.10	20.76	19.28	20.38	23.60
Notchi	43.31	31.42	28.44	34.40	34.92
Pungam	40.12	36.95	22.18	33.08	32.17
Captan	31.40	27.95	22.33	27.22	30.14
Vit E	41.51	39.87	26.41	35.93	41.88
$CaCl_2$	39.63	31.17	25.53	32.11	41.03
H-DH	30.65	24.84	22.17	25.90	36.14
Mean	35.17	30.06	25.60	29.01	35.85
Control	27.86	26.90	21.18	27.00	32.14

	T	A	TxA
SE $\bar{d}$	0.898	0.568	1.978
CD (P=0.05)	1.81	1.15	3.64

4.2.2.5. Flower production (Table 12)

The number of flowers per plant were ranged from 98 to 52 in non aged and aged control. There was a reduction in flower production in mildly (A_1) , moderately (A_2) and severely (A_3) aged seed progenies to an extent of 26, 39 and 47 per cent over respective control.

Among the treatments, Acacia, Vit E and Neem treatment of non aged seed progenies showed an increased flower production to an extent of 46, 36 and 26 per cent over the control respectively.

Almost all treatments showed an increased flower production in mildly (A_1) aged seed progenies to an extent of 11 to 53 per cent over the control.

Whereas, among the treatments Acacia, Notchi, Pungam and Vit E treatment in moderately (A_2) aged seed progenies recorded an increase of 20, 13, 22 and 23 per cent respectively over the control. However, in severely (A_3) aged seed progenies, Acacia, Arappu, Notchi and Vit E an increase of 12, 13, 10 and 15 per cent respectively over control was recorded.

4.2.2.6. Fruit length (cm) (Table 13)

The fruit length of Brinjal cv. PKM 1 was ranged from 5.8 to 7.3 cm among aged and non aged progenies. There was a reduction in fruit length to an extent of 5 and 16 per cent in the moderately (A_2) and severely (A_3) aged seed progenies respectively. Among the treatments, Acacia, Vit E, $CaCl_2$ and Hy-dehydration increased the fruit length of non aged seed progenies to an extent of 13, 27, 23 and 13 per

Table 12. Effect of pre-sowing seed treatments on the flower number in differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	110	72	58	80.0	143
Arappu	98	64	59	73.6	107
Neem	80	60	53	64.3	123
Notchi	88	68	57	71.0	85
Pungam	86	73	56	71.6	95
Captan	81	60	51	64.0	105
Vit E	96	67	60	74.3	133
$CaCl_2$	82	64	54	66.6	102
H-DH	84	65	53	67.3	108
Mean	89.4	65.9	55.6	70.3	111.2
Control	72	60	52	61.6	98

	T	A	TxA
SE $\bar{d}$	5.09	8.72	6.14
CD (P=0.05)	10.23	17.53	12.41

Table 13. Effect of pre-sowing seed treatments on the Fruit length (cm) in differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	7.82	7.54	7.00	7.54	8.36
Arappu	7.30	7.15	6.93	7.12	7.30
Neem	7.35	7.29	5.65	6.76	7.65
Notchi	7.44	7.39	6.91	7.24	7.98
Pungam	7.48	7.41	6.91	7.26	7.90
Captan	7.56	6.73	6.31	6.86	7.68
Vit E	8.13	7.55	7.48	7.72	8.81
$CaCl_2$	8.07	7.00	6.64	7.23	8.53
H-DH	6.96	6.85	6.82	6.88	7.84
Mean	7.56	7.20	6.74	7.06	8.00
Control	6.92	6.57	5.82	6.43	7.31

	T	A	TxA
SE $\bar{d}$	0.198	0.125	0.395
CD (P=0.05)	0.39	0.25	0.78

cent respectively. Acacia and Vit E alone increased the fruit length of mildly (A_1) aged seed progenies significantly.

Whereas, Acacia, Arappu, Notchi, Captan Vit E and $CaCl_2$ increased the fruit length of moderately aged (A_2) seed progenies over the control significantly. In severely (A_3) aged seed progenies Acacia, Arappu, Pungam, Vit E and $CaCl_2$ increased the fruit length over the control. Among the treatments, Vit E alone had consistently increased the fruit length of both non aged and differentially aged seed progenies over their respective control.

The interaction between treatment and ageing were non significant. Almost all treatments, in both non aged and differentially aged seed progenies, the fruit length was more in the first two pickings and there was a gradual reduction in subsequent pickings.

4.2.2.7. Fruit diameter (cm) (Table 14)

The fruit diameter of Brinjal cv. PKM-1 was ranged from 4.26 to 4.92 cm among aged and non aged seed progenies. There was a reduction to fruit diameter to an extent of 6, 7 and 13 per cent in mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies respectively.

Among the treatments, Vit E and $CaCl_2$ improved the diameter of non aged seed progenies to an extent of 8 and 6 per cent respectively. Whereas, Acacia, Hy-dehydration and Notchi were on a par with each other in improving the fruit diameter.

Among the treatments, Notchi, Vit E, Acacia,

Table 14. **Effect of pre-sowing seed treatments on the Fruit diameter (cm) in differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	5.24	5.17	5.12	5.17	5.34
Arappu	4.83	4.65	4.64	4.70	5.27
Neem	5.16	4.91	4.89	4.98	5.26
Notchi	5.28	5.15	4.37	4.93	5.29
Pungam	4.83	4.69	4.52	4.68	5.14
Captan	4.85	4.79	4.52	4.72	5.01
Vit E	5.26	5.10	4.83	5.06	5.32
$CaCl_2$	5.20	5.08	4.90	5.06	5.39
H-DH	4.98	4.86	4.51	4.78	5.17
Mean	5.07	4.82	4.70	4.90	5.24
Control	4.67	4.56	4.26	4.50	4.92

	T	A	TxA
SE $\bar{d}$	0.10	0.06	0.20
CD (P=0.05)	0.20	0.12	0.40

$CaCl_2$ and Neem treated seed progenies of mildly aged seeds recorded an increase of 12 to 14 per cent over the control.

Almost all treatments increased the fruit diameter of moderately (A_2) and severely (A_3) aged seed progenies to an extent of 2 to 16 and 6 to 24 per cent respectively over the respective control. However, the highest fruit diameter of 5.28 and 5.15 cm was recorded by Notchi in mildly (A_1) and moderately (A_2) aged seed progenies respectively. Whereas, Acacia recorded highest fruit diameter of 5.12 cm in severely (A_3) aged progenies.

4.2.2.8. Fruit volume(cc) (Table 15)

Among aged and non aged seed progenies the fruit volume of brinjal cv. PKM 1 ranged from 67.5 to 102 cc respectively. There was a reduction in mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies to an extent of 10, 21 and 34 per cent respectively over the control.

Among the treatments, Vit E, $CaCl_2$ and Acacia recorded sizeable increase in fruit volume of non aged (A_0) seed progenies to an extent of 42, 29 and 23 per cent respectively over the control.

Whereas, among the treatments, Acacia, Neem, Vit E, $CaCl_2$ and Arappu treatment recorded an increase of 47, 36, 34, 28 and 22 per cent respectively in mildly (A_1) aged seed progenies over the control.

Almost all the treatments showed a sizeable increase in fruit volume of moderately (A_2) and severely (A_3) aged seed progenies to an extent of 10 to 63 and 7 to 60 per

Table 15. **Effect of pre-sowing seed treatments on the Fruit volume (cm^3) in differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	125.0	121.5	103.0	116.5	135.5
Arappu	101.0	95.0	86.5	94.1	112.0
Neem	121.5	112.0	94.0	109.1	125.0
Notchi	108.0	107.5	97.0	104.1	131.0
Pungam	101.5	86.0	85.5	91.0	117.0
Captan	92.0	88.5	79.5	86.6	108.5
Vit E	124.0	123.5	107.0	118.1	114.5
$CaCl_2$	117.5	107.0	94.0	106.1	131.5
H-DH	98.5	98.0	72.5	89.6	111.5
Mean	109.9	104.3	89.0	101.0	124.0
Control	92.0	80.5	67.5	80.0	102.0

	T	A	TxA
SE $\bar{d}$	4.9	3.1	9.8
CD (P=0.05)	9.6	6.1	19.3

cent respectively over the control.

However, the maximum fruit volume was recorded by Notchi in both moderately (A_2) and severely (A_3) aged seed progenies.

4.2.2.9. Fruit yield (kg. ha^{-1}) (Table 16)

The fruit yield ranged from 11,429 to 8,160 kg in non aged and differentially aged seed progenies respectively.

There was a reduction in fruit yield to and extent of 7, 14 and 29 per cent in mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies over the control respectively.

Among the treatments, Acacia, Vit E, Neem, Captan and Notchi registered an increased fruit yield of 47, 37, 34, 32 and 32 per cent in non aged seed progneies over the control respectively.

Whereas, an increase in fruit yield to an extent of 5 to 40, 4 to 40 and 5 to 69 per cent was recorded in mildly (A_1), moderately (A_2) and severely (A_3) aged seed progneies respectively .

However, among all treatments, Acacia and Vit E treatment alone recorded a seizable increase in fruit yield of mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies.

4.2.2.10. Seed yield (Kg. ha^{-1}) (Table 17)

Seed yield obtained from non aged and differentially aged seed progenies were ranged from 125.6 to 78.7 kg per ha respectively. There was a reduction in seed

Table 16. **Effect of pre-sowing seed treatments on the Fruit yield (kg.ha^{-1}) in differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	14,196	13,838	13,795	13,943	16,805
Arappu	12,834	11,196	10,246	11,429	13,300
Neem	13,606	13,624	12,467	13,232	15,324
Notchi	12,379	10,829	9,664	10,957	15,051
Pungam	12,263	11,196	10,344	11,267	14,418
Captan	11,589	11,116	9,333	10,679	13,770
Vit E	14,891	13,184	12,911	13,662	15,622
$CaCl_2$	13,693	12,365	12,012	12,690	15,051
H-DH	13,486	10,253	8,539	10,759	13,500
Mean	13,304	12,903	11,247	12,484	13,570
Control	10,643	9,864	8,160	9,555	11,429

	T	A	TxA
SE $\bar{d}$	712	440	1401
CD (P=0.05)	1419	890	2832

Table 17. Effect of pre-sowing seed treatments on the seed yield (kg. ha^{-1}) in differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	156.0	146.7	131.6	143.7	184.7
Arappu	141.0	123.0	112.6	125.5	146.2
Neem	149.7	140.5	137.0	142.4	168.4
Notchi	136.0	119.0	106.2	120.4	130.3
Pungam	134.7	123.0	113.7	123.8	158.4
Captan	127.4	122.2	106.9	118.8	115.4
Vit E	163.6	144.9	141.8	150.1	150.1
$CaCl_2$	151.3	135.9	131.9	139.7	139.5
H-DH	148.2	112.7	93.8	118.2	118.0
Mean	145.3	129.4	119.5	131.4	145.7
Control	116.9	108.4	88.7	104.6	125.6

	T	A	TxA
SE $\bar{d}$	9.68	12.15	18.43
CD (P=0.05)	19.56	24.56	37.24

yield to an extent of 7, 14 and 37 per cent in mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies over the control (A_0) respectively.

Among the treatments, Acacia, Vit E, Neem and Notchi treatment recorded an increase of 47, 37, 34 and 32 per cent over the control respectively in non aged seed progenies.

Almost all the treatments showed an increased seed yield in mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies to an extent of 9 to 40, 4 to 42 and 6 to 60 per cent over the respective control.

However, among the treatments, Acacia in non aged (A_0) seed progenies, and Vit E in differentially (A_1, A_2 and A_3) aged seed progenies registered a better increase in seed yield to an extent of 47, 40,42 and 60 per cent over the respective control.

4.2.2.11. Seed number per fruit (Table 18)

The seed number per fruit was ranged from 1,654 to 1,329 in non aged and differentially aged seed progenies amounting a reduction of 20 per cent.

There was a reduction in seed number to an extent of 8, 14 and 20 per cent in respect of mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies over non aged untreated control.

Among the treatments, Vit E, $CaCl_2$ and Acacia improved the number of seeds per fruit to an extent of 20, 14 and 10 per cent respectively over the control in non aged seed progenies.

Table 18. **Effect of pre-sowing seed treatments on the seed number per fruit in differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	1,747	1,739	1,460	1,648.6	1,814
Arappu	1,391	1,346	1,328	1,355.0	1,499
Neem	1,585	1,504	1,520	1,536.3	1,668
Notchi	1,642	1,476	1,381	1,499.6	1,733
Pungam	1,489	1,354	1,255	1,366.0	1,676
Captan	1,529	1,466	1,300	1,431.6	1,693
Vit E	1,689	1,679	1,618	1,662.0	1,984
$CaCl_2$	1,677	1,550	1,462	1,563.0	1,893
H-DH	1,389	1,303	1,301	1,331.0	1,575
Mean	1,570.8	1,490.7	1,402.7	1,488.0	1,726.1
Control	1,517	1,422	1,329	1,422.6	1,554

	T	A	TxA
SE $\bar{d}$	75.5	47.5	168.1
CD (P=0.05)	148	93	331

Whereas, among the treatments, Acacia, Vit E and $CaCl_2$ improved the seed number of mildly (A_1) and moderately (A_2) aged seed progenies to an extent of 10 to 15 and 9 to 22 per cent over the respective control.

However, in severely (A_3) aged seed progenies Vit E, Acacia and $CaCl_2$ treatment increased the seed number per fruit to an extent of 10 to 22 per cent over the control.

4.2.2.12. Seed recovery (Table 19)

The seed recovery of differentially aged seed progenies was ranged from 4.5 to 3.6 per cent. There was a reduction in seed recovery of moderately (A_2) and severely (A_3) aged seed progenies to an extent of 12 and 20 per cent over the non aged control.

Among the treatments, there was no significant difference in seed recovery in either non aged or differentially aged seed progenies.

4.2.2.13. Earliness Index (Table 20)

The earliness in seed yield of differentially aged and non aged seeds were ranged from 2.3 to 3.79.

Among the treatments of non aged seed progenies, Vit E (28%) followed by Acacia (25%) and Arappu (21%) showed earliness than the control.

Almost all treatments showed an earliness of 4 to 28 per cent in mildly (A_1) aged seed progenies. Whereas, in moderately (A_2) aged seed progenies Acacia, Vit E, Arappu and $CaCl_2$ treatments recorded an earliness to an extent of 30, 29, 23 and 19 per cent over the respective control. However, an increased earliness was registered by Vit E

Table 19. **Effect of pre-sowing seed treatments on the seed recovery (%) in differentially aged seeds of brinjal cv. PKM 1**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	4.70	3.93	3.75	4.12	4.95
Arappu	4.35	4.10	4.10	4.18	4.85
Neem	4.48	4.02	3.95	4.15	4.60
Notchi	4.20	3.94	3.80	3.98	4.35
Pungam	4.40	4.30	4.20	4.30	5.00
Captan	4.25	4.15	4.00	4.13	4.70
Vit E	4.42	4.10	3.95	4.15	4.50
$CaCl_2$	4.15	4.12	3.70	3.99	4.70
H-DH	4.50	4.25	4.10	4.28	4.60
Mean	4.38	4.10	3.95	4.15	4.69
Control	4.12	3.96	3.60	3.89	4.50

	T	A	TxA
SE $\bar{d}$	NS	0.21	NS
CD (P=0.05)		0.42	

Table 20. Effect of pre sowing treatments on earliness index (for seed yield) in differentially aged seeds of brinjal cv. PKM 1

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	4.44	4.16	2.77	3.79	4.73
Arappu	4.31	3.84	2.79	3.65	4.59
Neem	3.82	3.61	2.62	3.35	4.07
Notchi	4.12	3.41	2.61	3.38	4.39
Pungam	4.18	3.35	2.88	3.47	4.45
Captan	3.88	3.10	2.38	3.12	4.13
Vit E	4.56	4.03	3.28	3.95	4.86
$CaCl_2$	4.22	3.72	2.52	3.48	4.50
H-DH	3.72	3.22	2.56	3.16	3.93
Mean	**4.14**	**3.60**	**2.71**	**3.48**	**4.40**
Control	3.56	3.12	2.30	2.99	3.79

	T	A	TxA
SE $\bar{d}$	0.08	0.12	0.17
CD. at 5%	0.16	0.24	0.34

(47%), Arappu (21%), Acacia (20%) and $CaCl_2$ (18%) in severely (A_3) aged seed progenies over the control.

4.2.3. Performance of resultant seed

4.2.3.1. Germination percentage of resultant seed (Table 21)

Significant results were obtained for germination between treatments, ageing and their interaction.

Among differential ageing, germination of resultant seeds of mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies recorded 8.1, 9.8 and 20 per cent reduction over the non aged control.

Among the treatments of non aged seed progenies, only Vit E treatment showed significant increase in per cent germination over the control.

Among the treatments, Vit E and Acacia recorded 87 and 84 per cent germination which is 7.4 and 4.4 per cent increase over the control of mildly (A_1) aged seed progenies.

Whereas, no treatment in moderately (A_2) and severely (A_3) aged seed progenies increased the per cent germination significantly over the respective control.

Wider variation in per cent germination was observed between non aged and severely (A_3) aged seed progenies. Whereas, the differences were minimum between mildly (A_1) and moderately (A_2) aged seed progenies.

4.2.3.2. Vigour index of resultant seed (Table 22)

Significant results were obtained for vigour index of resultant seed between treatments, ageing and their interaction.

Among the untreated differentially aged seeds,

Table 21. **Influence of ageing of source seed on the laboratory performance of resultant seed-germination percentage**

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	84.0 (66.42)	82.0 (64.90)	78.0 (62.03)	81.3 (64.38)	90.0 (71.57)
Arappu	82.0 (64.90)	79.0 (62.73)	77.0 (61.34)	79.0 (62.73)	87.0 (68.87)
Neem	82.0 (64.90)	78.0 (62.03)	78.0 (60.67)	78.3 (62.24)	86.0 (68.03)
Notchi	79.0 (62.73)	78.0 (62.03)	75.0 (60.00)	77.3 (61.55)	86.0 (68.03)
Pungam	82.0 (64.90)	77.0 (61.34)	75.0 (60.00)	78.0 (62.03)	84.0 (66.42)
Captan	80.0 (63.43)	78.0 (62.03)	77.0 (61.34)	78.3 (62.24)	86.0 (68.03)
Vit E	87.0 (68.87)	83.0 (65.65)	79.0 (62.73)	83.0 (65.65)	90.0 (71.57)
$CaCl_2$	83.0 (65.65)	79.0 (62.73)	78.0 (62.03)	79.3 (62.94)	85.0 (67.27)
H-DH	79.0 (62.73)	78.0 (62.03)	76.0 (60.67)	77.7 (61.82)	82.0 (64.90)
Mean	81.9 (64.82)	79.1 (62.80)	76.8 (61.21)	79.2 (62.87)	86.2 (68.19)
Control	82.0 (64.90)	79.0 (62.73)	78.0 (62.03)	79.6 (63.15)	88.0 (69.73)

	T	A	TxA
SE $\bar{d}$	0.81	0.51	1.62
CD (P=0.05)	1.60	1.01	3.20

Figures in paranthesis are arcsine transformed values

Table 22. Influence of ageing of source seed on the laboratory performance of resultant seed-vigour index

Treatment	Ageing (A)				
	A_1	A_2	A_3	Mean	A_0
Acacia	923	893	703	839.6	976
Arappu	808	744	676	742.6	979
Neem	835	822	620	759.0	920
Notchi	879	854	633	788.6	971
Pungam	934	894	757	875.0	977
Captan	895	878	689	820.6	918
Vit E	974	852	714	846.6	998
$CaCl_2$	945	839	754	857.3	987
H-DH	865	857	750	824.0	930
Mean	895.3	848.1	707.7	817.7	969.0
Control	909	857	710	825.3	963

	T	A	TxA
SE $\bar{d}$	12.0	7.7	24.4
CD (P=0.05)	23.7	15.2	48.2

there was a reduction in vigour index to an extent of 5, 11 and 26 per cent in mildly (A_1), moderately (A_2) and severely (A_3) aged seed progenies over control.

Among the treatments of non aged seed progenies, Vit E alone showed significantly higher vigour over the control.

Among the treatments, Vit E alone improved significantly the vigour index in mildly (A_1) aged seed progenies. Whereas, in moderately (A_2) and severely (A_3) aged seed progenies no treatment showed significant increase in vigour than the respective control.

4.3. Influence of water holding capacity and seed treatment on germination and seedling vigour in different soils

Significant results were obtained between soils, water holding capacities, seed treatments and their interactions in speed of germination, germination percentage, root length, shoot length, dry matter production and vigour index. However, non significant results were obtained between soils for dry matter production.

4.3.1. Speed of germination (Table 23)

The speed of germination was significantly higher at 40 followed by 60, 30 and 80 per cent water holding capacity in untreated control. Among soil types. the speed of germination was significantly higher at 40 followed by 60 and 30 per cent water holding capacity in red soil than in black soil.

At 30 per cent water holding capacity irrespective of soil type, Vit C followed by Vit E, Arappu, Pungam and

Table 23. Influence of water holding capacity and seed treatment on speed of germination of brinjal cv. PKM-1 in different soils

Treatment	Water holding capacity																	
	30%			40%			60%			80%			100%			Mean		
	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean
Acacia	3.72	4.70	4.21	7.27	6.20	6.73	6.93	2.70	4.81	6.90	0.50	3.70	0.00	0.00	0.00	4.96	2.82	3.89
Arappu	7.34	6.40	6.89	7.23	11.50	9.36	10.35	6.10	8.22	9.90	4.95	7.42	0.00	0.00	0.00	6.96	5.79	6.37
Neem	3.90	6.60	5.25	7.95	11.00	9.47	8.00	5.00	6.50	10.30	2.95	6.62	1.40	0.00	0.70	6.32	5.11	5.71
Notchi	5.02	2.50	3.76	8.50	6.20	7.35	8.73	4.10	6.41	10.32	0.30	5.31	0.00	0.00	0.00	6.51	2.62	4.65
Pungam	7.02	6.45	6.73	8.18	12.70	10.44	8.87	8.11	8.49	9.50	2.26	6.06	2.60	0.00	1.40	7.23	5.97	6.60
Vit-C	9.36	10.10	9.73	10.03	13.00	11.51	10.93	11.80	11.36	11.36	4.65	8.00	6.36	0.00	3.18	9.61	5.89	7.75
Vit-E	7.14	11.95	9.54	9.10	12.70	10.90	9.51	12.40	10.95	10.72	3.15	6.93	7.94	0.00	3.97	8.88	8.04	8.46
H-DH	5.05	8.30	6.67	6.25	9.70	7.97	6.57	10.70	8.63	5.50	1.25	3.37	0.90	0.00	0.45	4.85	5.99	5.42
Mean	**6.06**	**7.12**	**6.59**	**8.05**	**10.37**	**9.21**	**8.75**	**7.60**	**8.17**	**9.30**	**2.54**	**5.92**	**2.39**	**0.0**	**1.19**	**6.90**	**5.27**	**6.08**
Control	3.00	4.60	3.80	4.00	8.35	6.17	4.60	7.30	5.95	4.40	2.70	3.55	0.0	0.0	0.0	3.20	4.54	3.89

	T	W	S	TxW	TxS	WxS	TxWxS
SE d	0.125	0.093	0.059	0.278	0.176	0.132	0.394
CD (P=0.05)	0.25	0.18	0.11	0.55	0.35	0.26	0.78

Hy-dehydration treatment showed significantly higher speed of germination than the rest of the treatments and control.

Among the soils, the treated seeds performed better in red soil than black soil. However, among treatments except Acacia and Notchi in red soil and Acacia and Neem in black soil all other treatments showed significantly higher speed of germination than control.

At 40 per cent water holding capacity, all the treatments except Acacia showed significantly higher speed of germination than control irrespective of soil type. However, Vit C recorded the highest among the treatments regardless of soil type.

Among the soils, higher speed of germination was observed in red soil than the black soil irrespective of treatment at 40 per cent water holding capacity. However, Vit C treatment alone recorded highest speed of germination in both black and red soil.

Among the treatments, Acacia and Notchi performed very poor in red soil compared to control. Whereas, in black soil all the treated seeds showed significantly higher speed of germination than control.

At 60 per cent water holding capacity, irrespective of soil type, all the treatments except Acacia, Neem and Notchi, recorded significantly higher speed of germination than control.

Among the soils, all the treatments performed better in red soil than black soil. However, Vit E (12.4) in red soil and Vit C (10.93) in black soil recorded highest speed of germination than the rest of the treatments and control.

At 80 per cent water holding capacity, all the treatments except Acacia and Hy-dehydration treatment were significantly higher than control, irrespective of soil type. Among the soils, all the treated seeds performed better in black soil than red soil. However, in red soil only Arappu and Vit C recorded significantly higher speed of germination than control and rest of the treatments. Whereas, in black soil all the treatments showed significantly higher speed of germination than control.

4.3.2. Germination (%) (Table 24)

Among the water holding capacities, the untreated seeds of Brinjal cv. PKM-1 recorded more than the standard germination percentage only at 40 and 60 per cent water holding capacities to an extent of 74 and 70 per cent respectively. Whereas, the germination percentage was 47 and 48 in 30 and 80 per cent water holding capacities respectively. The untreated seeds failed to germinate at 100 per cent water holding capacity.

In all water holding capacities except at 100 per cent the germination percentage was significantly higher in red soil than in black soil.

At 30 per cent water holding capacity, irrespective of soil type, none of the seed treatments helped to attain the standard germination percentage. However, Vit C and Vit E seed treatments recorded 65 and 60 per cent germination respectively followed by Arappu (54%)

Table 24. Influence of water holding capacity and seed treatment on germination of brinjal cv. PKM 1 in different soils

Treatment	Water holding capacity																	
	30%			40%			60%			80%			100%			Mean		
	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean
Acacia	32 (34.45)	36 (36.87)	34 (35.67)	68 (55.55)	44 (41.55)	56 (48.45)	60 (50.77)	28 (31.95)	44 (42.13)	56 (48.45)	16 (23.58)	36 (36.87)	00 (00.00)	00 (00.00)	00 (00.00)	43.2 (41.09)	22.4 (28.25)	32.8 (34.94)
Arappu	60 (50.77)	48 (45.85)	54 (47.29)	72 (58.05)	84 (66.42)	78 (62.02)	80 (63.93)	78 (62.03)	79 (62.93)	80 (63.43)	36 (36.37)	58 (49.60)	00 (00.00)	00 (00.00)	00 (00.00)	58.4 (49.84)	41.2 (39.93)	49.8 (44.89)
Neem	40 (39.23)	52 (46.14)	46 (42.71)	80 (63.43)	72 (58.05)	76 (60.67)	64 (53.13)	36 (36.87)	50 (45.00)	81 (63.43)	24 (29.33)	52 (46.14)	04 (11.54)	00 (00.00)	02 (8.13)	53.6 (47.06)	36.8 (37.35)	45.2 (42.25)
Notchi	48 (43.85)	20 (26.57)	34 (35.67)	68 (55.55)	48 (43.85)	58 (49.60)	72 (58.05)	32 (34.45)	52 (46.14)	64 (53.13)	16 (23.58)	40 (39.23)	00 (00.00)	00 (00.00)	00 (00.00)	50.4 (45.23)	20.8 (27.13)	35.6 (26.63)
Pungam	60 (50.77)	48 (43.83)	54 (47.29)	72 (58.05)	88 (69.79)	80 (63.43)	76 (60.67)	60 (50.77)	68 (55.55)	76 (60.67)	20 (26.57)	48 (43.83)	12 (20.27)	00 (00.00)	06 (14.18)	59.2 (50.30)	43.2 (41.09)	51.2 (45.69)
Vit-C	74 (59.34)	56 (48.45)	65 (53.13)	80 (63.43)	84 (66.42)	82 (64.90)	80 (63.43)	76 (60.67)	78 (62.02)	76 (60.67)	32 (34.45)	54 (47.29)	48 (43.85)	00 (00.00)	23 (28.66)	71.2 (51.54)	49.6 (44.77)	60.4 (51.00)
Vit-E	48 (43.85)	72 (58.05)	60 (50.77)	80 (63.43)	80 (63.43)	80 (63.43)	76 (60.67)	72 (58.05)	74 (59.34)	72 (58.05)	12 (20.27)	42 (40.40)	56 (48.45)	00 (00.00)	28 (31.95)	66.4 (54.57)	47.2 (43.39)	56.8 (48.91)
B-DH	40 (39.23)	52 (46.14)	46 (42.70)	56 (48.45)	60 (50.07)	58 (59.60)	52 (46.14)	66 (54.33)	59 (50.18)	40 (39.23)	20 (26.57)	30 (33.21)	08 (16.43)	00 (00.00)	04 (11.54)	39.2 (38.76)	39.6 (39.00)	39.4 (38.88)
Mean	50 (45.00)	48 (43.83)	49 (44.43)	72 (58.05)	70 (56.79)	71 (57.42)	70 (56.74)	51 (45.57)	60.5 (51.06)	68 (55.55)	16 (23.58)	42 (40.40)	16 (23.58)	00 (00.00)	8 (16.43)	55.2 (47.98)	37.6 (37.82)	46.2 (42.82)
Control	42 (40.40)	55 (47.87)	47 (43.28)	72 (58.05)	76 (60.67)	74 (59.34)	68 (55.55)	72 (58.05)	70 (56.79)	38 (31.95)	8 (16.43)	23 (28.66)	00 (00.00)	00 (00.00)	00 (00.00)	44.0 (41.55)	42.2 (40.51)	43.1 (41.03)

	T	W	S	TxW	TxS	WxS	TxWxS
SE $\bar{d}$	0.61	0.46	0.29	0.37	0.87	0.65	1.94
CD (P=0.05)	1.2	0.91	0.57	0.73	1.71	1.28	3.83

Figures in paranthesis are arcsine transformed values

and Pungam (54%).

At 30 per cent water holding capacity Vit C in black soil and Vit E in red soil recorded the highest percentage germination of 74 and 72 respectively.

In general, the treated seeds germination better in black soil than red soil.

At 40 per cent water holding capacity almost all the treated seeds except Hy-dehydration treatment germinated better in black soil than in red soil. Irrespective of soils, at 40 per cent water holding capacity Vit C, Vit E, Pungam, Arappu and Neem recorded more than the standard germination percentage registering 82, 80, 80, 78 and 76 respectively.

Among the treatments Vit C, Vit E, Pungam, Arappu and Neem recorded better germination than the rest of the treatments in both the soils.

At 60 per cent water holding capacity all the treatments except Hy-dehydration treatments germinated better in black soil than the red soil. Irrespective of soil type, at 60 per cent water holding capacity, Arappu and Vit C recorded highest percentage of 79 and 78 respectively followed by Vit E (74%) and Pungam (68%). However, irrespective of soil types, the other treatments viz. Acacia, Neem, Notchi and Hy-dehydration treatments failed to establish the standard germination percentage.

At 60 per cent water holding capacity, in black soil, Arappu, Vit C, Vit E, Pungam and Notchi recorded 80, 80, 76, 76 and 72 per cent germination respectively as against 68 per cent in untreated control. Whereas, in red soil, Arappu, Vit C and Vit E recorded more than the standard germination registering 78, 76 and 72 per cent respectively.

At 80 per cent water holding capacity, irrespective of soil type, none of the treatments registered standard germination percentage. However, Arappu, Neem and Vit C registered 58, 52 and 54 per cent germination which is 10, 4 and 6 per cent increase over the control respectively.

Almost all treatments except Acacia Notchi and Hy-dehydration recorded more than the standard germination percentage in black soil. Whereas all the treatments with no exception failed to establish minimum standard germination percentage in red soil.

At 100 per cent water holding capacity, neither soil type nor seed treatments helped the seeds to record the minimum standard germination percentage. However, in black soil, Vit C and Vit E were much better than the rest. The study revealed that the response to seed treatments and pelleting was comparatively more in black soil than in red soil at all water holding capacities.

4.3.3. Root Length (cm) (Table 25)

The maximum root length was recorded by untreated control seeds at 40 per cent water holding capacity followed by 30, 60 and 80 per cent. Whereas, irrespective of method of treatment, the treated seed recorded maximum root length at 30 per cent water holding capacity and there was a gradual and sequential reduction in root length when the water holding capacity increased.

Table 25. Influence of water holding capacity and seed treatment on root legnth (cm) of brinjal cv. PKM 1 in different soils

Treatment	Water holding capacity																	
	30%			40%			60%			80%			100%			Mean		
	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean
Acacia	4.0	6.4	5.20	4.6	5.3	4.95	4.9	5.4	5.15	5.0	4.4	4.70	0.0	0.0	0.00	3.70	4.30	4.00
Arappu	5.0	5.6	5.30	4.7	6.0	5.35	5.5	5.3	5.40	5.1	3.9	4.50	0.0	0.0	0.00	4.06	4.16	4.11
Neem	3.9	5.0	4.45	5.6	5.2	5.40	5.5	5.1	5.30	5.2	5.5	5.35	3.2	0.0	1.60	4.08	4.16	4.11
Notchi	4.6	4.7	4.65	5.6	5.2	5.40	5.0	5.0	5.00	4.3	3.7	4.00	0.0	0.0	0.00	3.90	3.72	3.81
Pungam	3.9	5.3	4.60	5.1	5.5	5.30	5.2	5.7	5.45	4.8	4.9	4.85	3.1	0.0	1.55	4.42	4.28	4.35
Vit-C	5.4	5.7	5.55	4.9	6.1	5.50	5.2	5.4	5.30	4.9	4.8	4.85	3.8	0.0	1.90	4.84	4.40	4.62
Vit-E	5.0	6.2	5.60	4.7	5.7	5.20	4.1	5.1	4.60	4.8	4.4	4.60	4.1	0.0	2.05	4.54	4.28	4.41
H-DH	4.2	6.1	5.15	3.7	5.6	4.65	4.1	4.6	4.35	4.3	4.1	4.20	3.1	0.0	1.55	3.88	4.08	3.98
Mean	4.5	5.62	5.06	4.86	5.57	5.22	4.93	5.2	5.07	4.80	4.46	4.63	2.16	0.0	1.08	4.17	4.17	4.17
Control	3.9	4.5	4.2	3.8	5.4	4.60	3.9	4.5	4.20	3.2	3.9	3.55	0.0	0.0	0.00	2.94	3.66	2.25

	T	W	S	TxW	TxS	WxS	TxWxS
SE $\bar{d}$	0.07	0.15	0.10	0.15	0.093	0.069	0.201
CD (P=0.05)	0.13	0.30	0.19	0.29	0.18	0.14	0.41

At 30, 40 and 60 per cent water holding capacity all the treatments recorded higher root length in red soil than in black soil. Whereas, at 80 per cent water holding capacity all the treatments recorded higher root length in black soil than red soil.

At 30 per cent water holding capacity, Vit E, Vit C, Arappu, Acacia and Hy-dehydration treatments were on a par and recorded significantly higher root length than the rest of the treatments and control irrespective of the soil type.

However, Vit C, Arappu and Vit E were on a par and recorded significantly higher root length in black soil than the control and the rest of the treatments.

At 40 per cent water holding capacity, irrespective of treatments, the root length was more in red soil than in black soil. Irrespective of soils, Arappu, Neem, Notchi, Pungam, Vit C and Vit E were on a par to each other. In black soil, Neem and Notchi recorded significantly higher root length than the rest of the treatments and control. Whereas, in red soil Arappu, Vit C, Vit E, Pungam and Hy-dehydration were on a par and recorded significantly more root length than the rest of the treatments and the control.

At 60 per cent water holding capacity, irrespective of soil type, Acacia, Arappu, Neem, Notchi, Pungam, Vit C were on a par and recorded more root length than the rest of the treatments and the control. However, in black soil, Acacia, Arappu, Neem, Notchi, Pungam and Vit C treatments were on a par and recorded higher root length than the rest and control. Whereas, in red soil Pungam recorded the maximum root length and except Hy-dehydration all other treatments were on a par with each other.

At 80 per cent water holding capacity, irrespective of the soil type, Neem recorded maximum root length and Acacia, Arappu, Pungam, Vit C and Vit E were on a par with each other. In black soil, except Hy-dehydration which recorded the least root length, the rest of the treatments were on a par and significantly more than the control. However, in red soil, the Neem recorded the maximum root length and Acacia, Pungam, and Vit C were on a par and better than the rest of the treatments and the control.

4.3.4. Shoot length (cm) (Table 26)

The maximum shoot length (5.0 cm) was recorded by untreated control seeds at 60 per cent water holding capacity followed by 4.7 and 4.6 cm at 80 and 30 per cent water holding capacity respectively. Whereas, irrespective of treatments and soil type, the treated seed recorded minimum shoot length at 30 per cent water holding capacity and there was a gradual and sequential increase in shoot length as and when the water holding capacity increased with an exception at 100 per cent.

At 30, 40 and 60 per cent water holding capacity, all the treatments recorded higher shoot length in red soil than in black soil. Whereas, at 80 per cent water holding capacity the shoot length was significantly higher in black soil than red soil.

Irrespective of soil type, at 30 per cent water

Table 26. Influence of water holding capacity and seed treatment on shoot length (cm) of brinjal cv. PKM 1 in different soils

Treatment	Water holding capacity																	
	30%			40%			60%			80%			100%			Mean		
	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean
Acacia	3.50	3.85	3.67	3.28	4.30	3.79	4.60	4.40	4.50	4.33	4.15	4.24	0.0	0.0	0.00	3.38	3.54	3.46
Arappu	3.30	4.30	3.80	3.90	4.60	4.25	5.55	4.60	5.07	5.24	4.20	4.72	0.0	0.0	0.00	3.88	3.64	3.76
Neem	3.95	4.70	4.24	4.04	4.60	4.32	5.87	4.65	5.26	5.79	4.30	5.04	4.4	0.0	2.20	4.40	3.56	3.98
Notchi	3.02	4.15	3.58	3.82	4.75	4.28	5.13	4.47	4.80	5.71	4.60	5.15	0.0	0.0	0.00	3.52	3.68	3.60
Pungam	3.52	4.20	3.86	3.72	5.05	4.38	5.37	4.90	5.13	5.11	4.35	4.73	5.1	0.0	2.55	4.46	3.98	4.22
Vit-C	4.00	4.80	4.40	3.87	5.40	4.63	4.31	4.95	4.63	5.16	4.85	5.00	5.5	0.0	2.75	5.42	3.90	4.66
Vit-E	4.99	4.30	4.64	4.72	5.30	5.01	6.08	5.32	5.70	5.92	4.65	5.28	5.6	0.0	2.80	5.08	3.96	4.52
B-DH	4.23	4.70	4.46	4.32	5.45	4.88	5.76	4.91	5.33	5.62	4.80	5.21	5.3	0.0	2.65	4.70	3.64	4.17
Mean	3.79	4.37	4.08	3.97	4.93	4.45	5.33	4.77	5.05	5.36	4.48	4.92	9.23	0.0	1.61	4.33	3.71	4.02
Control	4.35	4.80	4.57	3.75	4.33	4.04	5.20	4.72	4.96	5.06	4.40	4.73	0.0	0.0	0.00	2.94	3.32	3.13

	T	W	S	TxW	TxS	WxS	TxWxS
SE $\bar{d}$	0.12	0.09	0.06	0.27	0.17	0.13	0.38
CD (P=0.05)	0.23	0.17	0.11	0.53	0.33	0.25	0.74

holding capacity, Vit E, Vit C, Hy-dehydration and Neem treatments recorded significantly higher than the rest of treatments.

At 30 per cent water holding capacity, all the treatments except Vit E recorded significantly higher shoot length in red soil than in black soil.

At 40 per cent water holding capacity, irrespective of the treatments, the shoot length was more in red soil than black soil. Irrespective of soil type, Vit E and Hy-dehydration treatment showed significantly higher shoot length than the rest and control. However, all other treatments recorded higher than the control and were on a par with each other.

At 40 per cent water holding capacity, except Acacia, Arappu and Notchi all other treatments recorded significantly higher in red soil than black soil and also respective control.

At 60 per cent water holding capacity, irrespective of the soil type, all the treatments except Acacia and Vit C registered significantly higher shoot length than control and also on a par with each other.

At 60 per cent water holding capacity, all the treatments except Vit C, Acacia and Notchi recorded higher in black soil than control. Whereas, in red soil, Vit E registered higher (5.3cm) among treatments followed by Vit C, Hy-dehydration and Pungam treatment.

At 80 per cent water holding capacity, Vit E recorded highest (5.28cm) shoot length followed by hy-dehydration (5.21cm), Notchi (5.15cm), Neem (5.04 cm), Vit C (5.00 cm) and Pungam (4.73cm) treatments irrespective of soil type.

Whereas, all the treatments with no exception performed better in black soil than red soil. However, Vit E (5.92 cm) in black soil and Vit C (4.85 cm) red soil recorded highest among the treatments at 80 per cent water holding capacity.

At 100 per cent water holding capacity, black soil was better than red soil irrespective of the treatments.

4.3.5. Vigour index (Table 27)

The vigour index of untreated control recorded maximum (641) at 40 per cent water holding capacity followed by 630, 428, 190 and 0 at 60,30,80 and 100 per cent water holding capacity irrespective of soil type.

Irrespective of water holding capacity of the soil type, the untreated control performed better in red soil than black soil.

Among the treatments, Vit C recorded maximum vigour index (641) at 30 per cent water holding capacity followed by Vit E irrespective of soil type. Whereas, Notchi (271) and Acacia (30) pelleted seeds recorded less than control. However Arappu (486), Neem (405), Pungam (450) and Hy-dehydration (449) were on a par with control (428).

Among the soils, at 30 per cent water holding capacity, treated seeds performed better in red soil than black soil. Among treatments Vit C in black soil and Vit E in red soil showed significantly higher vigour than the rest

Table: 27 Influence of water holding capacity and seed treatment on vigour index in different soils

Treatment	Water holding capacity																	
	30%			40%			60%			80%			100%			Mean		
	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean
Acacia	240	369	304	536	422	479	570	274	422	522	136	329	00	00	00	373	240	306
Arappu	498	475	486	619	865	742	884	772	828	827	291	559	00	00	00	565	480	523
Neem	307	504	405	771	706	738	728	351	539	879	235	557	30	00	15	543	359	451
Notchi	365	177	271	641	478	559	729	303	516	640	132	386	00	00	00	475	218	346
Pungam	445	456	450	635	928	781	803	636	719	753	185	469	98	00	49	546	441	493
Vit-C	695	588	641	702	966	834	761	786	773	764	308	536	446	00	223	673	529	601
Vit-E	479	756	617	754	880	817	773	750	761	757	108	432	537	00	268	660	498	579
H-DH	337	561	449	449	654	551	651	327	570	397	178	287	67	00	33	352	404	378
Mean	420	485	452	638	737	687	720	703	641	692	196	444	315	00	157	557	424	490
Control	346	511	428	544	739	641	619	642	630	314	66	190	00	00	00	364	391	377

	T	W	S	TxW	TxS	WxS	TxWxS
SE $\bar{d}$	10.89	8.10	5.12	25.31	15.37	11.46	34.38
CD (P=0.05)	21	16	10	48	30	22	68

of the treatments and the control.

Irrespective of soil type, at 40 per cent water holding capacity, among the treatments, Vit C (834), Vit E (817), Pungam (781), Arappu (742) and Neem (738) recorded significantly higher vigour than control (641). However, the vigour index of Acacia (479) recorded significantly lower than the control.

Among the soils, at 40 per cent water holding capacity, Vit C showed higher vigour followed by Pungam and Vit E in red soil. Whereas, in black soil, Neem followed by Vit E showed significantly higher than control.

Among the treatments, irrespective of soil type at 60 per cent water holding capacity, Pungam (828), Vit C (773) Vit E (761) and Pungam (719) showed significantly higher vigour index than control (630). Whereas, significant reduction in vigour index was observed in Acacia, Neem, Notchi and Hy-dehydration treatment.

Among the soil types, treated seeds showed significantly higher vigour in black soil than red soil. All the treatments, except Acacia and Hy-dehydration, showed significantly higher vigour than control in black soil. Whereas, in red soil only Vit C, Arappu and Vit E were significantly higher than control. However, Acacia, Neem and Notchi recorded significantly lower vigour index than the control in red soil.

Irrespective of soil type at 80 per cent water holding capacity, all the treatments showed significantly higher vigour than control. Among soil types, all the treatments performed better in black soil than rd soil. However Arappu and Neem in black soil and Vit C and Arappu in red soil showed good vigour compared to rest of the treatments and the control.

4.3.6. Dry matter production (Table 28)

Irrespective of the soil type, the dry matter production of untreated control recorded highest (1.07 mg) at 60 per cent water holding capacity followed by 40, 80 and 30 per cent water holding capacity. Irrespective of water holding capacity, the untreated control recorded higher dry matter production in red soil than the black soil.

Irrespective of soil type, at 30 per water holding capacity, the treated seeds produced significantly higher seedling dry weight. Whereas, among the soils, treated seeds performed better in red soil than the black soil. However, except Acacia an Hy-dehydration treatments all other treatments were on a par with each other in black soil and all the treatments with no exception were on a par with each other in red soil.

Among the treatments, Vit C (1.26 mg) in black soil and Notchi (1.20 mg) in red soil recorded maximum at 30 per cent water holding capacity.

Irrespective of soil type, all the treatments at 40 per cent water holding capacity were on a par with control. Among the soils, treated and untreated seeds performed better in red soil than black soil. However, Pungam and Vit E (1.30mg) were on par in red soil. Whereas, Arappu (1.23mg) and Vit C (1.19 mg) in black soil produced maximum

Table 28. Influence of water holding capacity and seed treatment on dry matter production (mg) of brinjal cv. PKM 1 in different soils

Treatment	Water holding capacity																	
	30%			40%			60%			80%			100%			Mean		
	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean	Black soil	Red soil	Mean
Acacia	1.05	1.10	1.075	1.13	1.10	1.115	0.96	1.28	1.120	0.98	1.20	1.09	0.00	0.0	0.00	0.82	0.94	0.88
Arappu	1.15	1.10	1.125	1.23	1.20	1.215	0.86	1.26	1.060	1.02	1.30	1.16	0.00	0.0	0.00	0.85	0.97	0.91
Neem	1.20	1.10	1.150	1.13	1.20	1.165	0.98	1.25	1.115	1.33	1.27	1.30	0.90	0.0	0.47	1.12	0.96	1.04
Notchi	1.17	1.30	1.235	1.16	1.20	1.180	0.88	1.28	1.080	0.96	1.10	1.03	0.00	0.0	0.00	0.83	0.98	0.90
Pungam	1.08	1.20	1.140	1.17	1.30	1.235	1.03	1.26	1.145	0.93	1.20	1.06	1.02	0.0	0.50	1.05	0.99	1.02
Vit-C	1.26	1.20	1.230	1.19	1.00	1.095	1.38	1.19	1.275	1.26	1.10	1.18	1.06	0.0	0.50	1.23	0.90	1.07
Vit-E	1.10	1.20	1.150	1.09	1.30	1.195	1.13	1.30	1.215	1.15	1.20	1.17	0.98	0.0	0.49	1.09	1.00	1.05
H-DH	0.95	1.11	1.030	1.02	1.10	1.060	1.01	1.15	1.083	1.06	1.19	1.12	0.80	0.0	0.40	0.97	0.91	0.94
Mean	1.08	1.13	1.110	1.14	1.13	1.170	1.04	1.25	1.140	1.05	1.22	1.13	0.60	0.0	0.30	0.98	0.95	0.96
Control	0.80	0.90	0.850	0.93	1.20	1.070	1.05	1.09	1.070	0.94	1.15	1.05	0.00	0.0	0.00	0.90	0.99	0.95

	T	W	S	TxW	TxS	WxS	TxWxS
SE d	0.03	0.024	NS	0.07	0.05	0.045	0.034
CD (P=0.05)	0.06	0.05		0.14	0.02	0.26	0.78

seedling dry weight at 40 per cent water holding capacity.

Irrespective of soil type at 60 per cent water holding capacity, all the treatments were on a par with control. Among the soils, red soil recorded comparatively higher drymatter than black soil. However, Vit C (1.36mg) in black soil and Vit E (1.30 mg) in red soil produced significantly higher dry seedling weight than the respective control. Whereas, in red soil all other treatments were on a par with control.

Regardless of soil type, all the treatments except Neem at 80 per cent water holding capacity were on a par with each other. Among the soils, at 80 per cent water holding capacity, the treated and untreated seeds performed better in red soil than black soil though the difference was non significant.

However, among the treatments, Neem pelleted seeds and Vit C in black soil and Arappu and Neem in red soil produced higher seedling dry weight than any other treatments at 80 per cent water holding capacity.

4.4. Influence of gamma irradiation on the seed quality of brinjal cv. PKM 1

Significant results were obtained between seed treatments, doses of irradiation, and their interaction for speed of germination, germination percentage, root and shoot length and vigour index (Table 29 and 30).

4.4.1. Speed of germination

When the dry seeds of Brinjal cv. PKM 1 were subjected to different doses of gamma radiation of 10 and 20

Table 29. Influence of gamma irradiation on the speed of germination and percentage germination in brinjal cv. PKM 1

Treatment (T)	GAMMA RADIATION 10Kr (K_1)	20Kr (K_2)	30Kr (K_3)	0Kr (K_0)
	Speed of germination			
T_1 - Water soaking	11.37	8.26	6.80	11.35
T_2 - Vit-C soaking	11.65	10.50	10.15	10.70
T_0 - Control	10.53	10.46	8.06	10.00
	T	K	T xK	
SE $\bar{d}$	0.15	0.17	0.30	
CD(P=0.05)	0.33	0.38	0.66	
	Germination (%)			
T_1 - Water soaking	50 (45.00)	36 (36.87)	24 (29.33)	80 (63.43)
T_2 - Vit-C soaking	88 (69.73)	84 (66.42)	80 (63.43)	80 (63.43)
T_0 - Control	84 (66.42)	84 (66.42)	64 (53.13)	79 (62.73)
	T	K	T x K	
SE $\bar{d}$	1.29	1.49	2.58	
CD(P=0.05)	2.18	3.2	5.6	

Figures in parantheses are arcsine transformed values.

Table: 30 Influence of gamma radiation on the root length, shoot length and vigour index in brinjal cv. PKM 1

Treatment (T)	GAMMA RADIATION 10Kr (K_1)	20Kr (K_2)	30Kr (K_3)	0Kr (K_0)
	Root Lenght (cm)			
T_1 - Water soaking	2.2	2.0	1.8	5.4
T_2 - Vit-C soaking	6.7	6.0	5.9	5.6
T_0 - Control	5.3	5.1	4.2	4.6
	T	K	T x K	
SE $\bar{d}$	0.15	0.17	0.3	
CD(P=0.05)	0.2	0.2	0.7	
	Shoot length (cm)			
T_1 - Water soaking	2.5	2.4	2.3	5.9
T_2 - Vit-C soaking	5.4	5.2	4.9	5.4
T_0 - Control	5.3	4.4	3.6	5.4
	T	K	T x K	
SE $\bar{d}$	0.106	0.12	0.21	
CD(P=0.05)	0.2	0.3	0.5	
	Vigour Index			
T_1 - Water soaking	235	158	98	904
T_2 - Vit-C soaking	1065	941	864	880
T_0 - Control	890	798	499	790
	T	K	T x K	
SE $\bar{d}$	28.20	30.8	45.1	
CD(P=0.05)	61.4	67.1	98.3	

Kr have no influence where as 30kr significantly reduced the speed of germination to an extent of 19 per cent. However when the seeds were soaked in water and in aqueous solution of Vit C and subjected to gamma radiation, the results indicated that the 10 kr has no influence on water soaked seeds. However, 20 and 30 kr reduced the speed of germination to an extent of 26 and 40 per cent respectively. Whereas, when the Vit C soaked seeds were subjected to the same doses of gamma-ray there was no significant reduction in the speed of germination.

4.4.2. Germination (%)

When the dry seeds were subjected to gamma radiation of 10 and 20 kr were on a par with control. Where as, 30 kr reduced the germination to an extent of 16 per cent. The Vit C and water soaked seeds when subjected to gamma radiation, 10, 20 and 30 kr reduced the germination of water soaked seeds to an extent of 30, 44 and 56 per cent respectively. However, 20 and 30 kr were on a par with control and 10 kr increased the germination of Vit C soaked seeds to an extent of 8 per cent.

4.4.3. Root length (cm)

There was no significant difference in the length of root of dry seeds when exposed to different levels of gamma radiation. However, 10, 20 and 30 Kr reduced the root length of water soaked seeds to an extent of 50, 63 and 81 per cent respectively. Whereas, when Vit C soaked seeds were exposed to gamma radiation, 20 and 30 Kr were on a par and 10 Kr increased the root length to an extent of 20 per cent.

4.4.4. **Shoot length (cm)**

The shoot length at 10 Kr was on a par with control. Whereas, 20 and 30 Kr reduced the shoot length to an extent of 19 and 33 per cent respectively.

Gamma radiation with 10, 20 and 30 Kr reduced the shoot length of water soaked seeds to an extent of 58, 65 and 66 per cent respectively. However, the gamma irradiation has no significant influence on Vit C soaked seeds.

4.4.5. **Vigour Index**

While, 10 Kr improved the vigour index of dry seeds to an extent of 13 per cent, the vigour index at 20 Kr was on par with the control. However, 30 Kr reduced the vigour index to an extent of 38 per cent.

Gamma radiation with 10, 20 and 30 Kr drastically reduced the vigour index of water soaked seeds. However, 20 and 30 Kr were on a par in Vit C soaked control seeds. Where as, 10 Kr improved the vigour index to an extent of 21 per cent.

4.5. **Effect of gamma radiation on differentially aged seeds of brinjal cv. PKM 1**

Significant results were obtained for gamma treatments, differential ageing, and their interactions for speed of germination, germination, root length, shoot length and vigour index (Table 31 and 32)

4.5.1. **Speed of germination**

While,10 and 20 Kr were on a par with control, 30 Kr ~~has~~ significantly reduced the speed of germination to an

Table 31. **Influence of gamma radiation on speed of germination and germination (%) in differentially aged seeds of brinjal cv. PKM 1**

Ageing (A)	Gamma radiation (10Kr)	(20Kr)	(30Kr)	Mean	(0Kr)
		Speed of germination			
A_1	9.27	8.43	3.88	7.19	7.31
A_2	8.40	6.57	3.46	6.14	3.69
A_3	5.43	3.16	2.54	3.71	2.66
Mean	7.70	6.05	3.29	5.68	4.64
A_0	10.53	10.46	8.06	9.68	10.00

	T	K	T X K
SE $\bar{d}$	0.22	0.22	0.38
CD(P=0.05)	0.50	0.50	0.86

Ageing (A)	(10Kr)	(20Kr)	(30Kr)	Mean	(0Kr)
		Germination (%)			
A_1	80	72	32	61.3	68
	(63.43)	(58.05)	(34.45)	(51.53)	(55.55)
A_2	48	36	28	37.3	32
	(43.85)	(36.87)	(31.95)	(37.64)	(34.45)
A_3	34	20	20	24.7	20
	(35.67)	(26.57)	(26.57)	(29.80)	(26.57)
Mean	54	42.7	26.7	41.1	40.0
	(47.29)	(40.80)	(31.11)	(39.87)	(39.23)
A_0	84	84	64	77.3	80
	(66.42)	(66.42)	(53.13)	(61.55)	(63.43)

	T	K	T x K
SE $\bar{d}$	1.18	1.18	2.13
CD(P=0.05)	2.7	2.7	4.8

Table 32. Influence of gamma radiation on root and shoot length (cm) and vigour index in differentially aged seeds of brinjal cv. PKM 1

Ageing (A)	Gamma radiation (10Kr)	(20Kr)	(30Kr)	Mean	(0Kr)
		Root length (cm)			
A_1	7.0	6.6	5.0	6.2	5.0
A_2	6.6	5.6	4.0	5.4	4.5
A_3	4.2	3.8	3.3	3.8	3.9
Mean	5.93	5.33	4.10	5.1	4.4
A_0	6.2	5.7	4.2	5.4	5.4

	T	K	T x K
SE $\bar{d}$	0.29	0.29	0.59
CD(P=0.05)	0.67	0.67	1.3

		Shoot length (cm)			
A_1	5.0	4.5	4.0	4.5	4.4
A_2	4.7	4.4	3.9	4.3	4.2
A_3	3.7	3.6	3.5	3.6	4.0
Mean	4.46	4.16	3.80	4.13	4.2
A_0	4.6	4.1	3.6	4.1	4.7

	T	K	T x K
SE $\bar{d}$	0.19	0.19	0.35
CD(P=0.05)	0.4	0.4	0.8

		Vigour Index			
A_1	960	799	288	682.3	639
A_2	542	360	221	374.3	278
A_3	269	150	136	185.0	158
Mean	590.3	436.3	215	413.8	358.3
A_0	907	823	435	721.6	808

	T	K	T x K
SE $\bar{d}$	20.8	20.8	38.48
CD(P=0.05)	47.4	47.4	87.7

extent of 20 per cent.

When 10 and 20Kr increased the speed of germination of mildly aged (A_1) seeds to an extent of 27 and 15 per cent respectively, 30 Kr significantly reduced the speed of germination to an extent of 40 per cent.

10 and 20 Kr increased the speed of germination of mildly aged (A_1) seeds to an extent of 23 and 15 per cent, moderately aged (A_2) seeds to an extent of 122 and 70 percent, and severely aged (A_3) seeds to an extent of 194 and 19 per cent respectively.

However, 30 Kr reduced the speed of germination to an extent of 47 per cent in mildly aged (A_1) seeds alone.

4.5.2. Germination (%)

10 and 20 Kr were on a par with control of non aged (A_0) seed. Whereas, 30 Kr reduced the germination to an extent of 24 per cent. 10 Kr increased the germination per cent of mildly aged (A_1), moderately aged (A_2) and severely aged (A_3) seed significantly to an extent of 12, 16 and 14 per cent respectively. While, 20 Kr was on par with control, 30 Kr reduced the germination of mildly aged (A_1) seeds to an extent of 36 per cent.

4.5.3. Root length (cm)

There was no significant influence in the non aged (A_0) and severely aged (A_3) seeds when subjected to different doses of gamma radiation. However, 10 Kr increased the root length of mildly aged (A_1) and moderately aged (A_2) seeds to an extent of 40 and 24 per cent respectively.

4.5.4. Shoot length (cm)

The shoot length was not influenced either positively or negatively when the non aged and differential aged seeds were exposed to gamma radiation.

4.5.5. Vigour index

10 Kr increased the vigour index of non aged (A_0), mildly aged (A_1), moderately aged (A_2) and severely aged (A_3) seeds significantly. However, 30 Kr reduced the vigour index of non aged (A_0) and mildly aged (A_1) seeds to an extent of 46 and 55 per cent respectively.

4.6. Effect of magnetic treatment on differentially aged seeds of brinjal cv. PKM 1

Significant results were obtained between duration of magnetic treatments, differential ageing, and their interaction for speed of germination, germination percentage, root and shoot length and vigour index (Table 33, 34 & 35).

4.6.1. Speed of germination

Among the magnetic treatments, the speed of germination of non aged seeds was increased by M_2 and M_3 treatments to an extent of 15 and 26 per cent respectively. Among the differentially aged seeds, M_2 and M_3 increased the speed of germination of A_1 (15 and 18%), A_2 (23 and 26%) and in A_3 only M_3 increased the speed of germination to an extent of 27 per cent.

4.6.2. Germination (%)

The magnetic seed treatments did not influence the non aged control seeds. However, the germination percentage of differentially aged seeds was increased by M_3 to an extent of 5, 4 and 7 per cent in A_1 , A_2 and A_3 respectively.

Table 33. Effect of magnetic treatment on speed of germination and germination percetage in differentially aged seeds of brinjal cv. PKM 1

Magnetic seed Treatment (M)	AGEING (A) (A_1)	(A_2)	(A_3)	Mean	(A_0)
		Speed of germination			
M_1	7.73	5.70	3.50	5.64	9.23
M_2	8.45	6.52	3.67	6.21	10.36
M_3	8.70	6.70	4.00	6.46	11.35
Mean	8.29	6.30	3.72	6.10	10.31
M_0	7.35	5.30	3.16	5.27	9.01

	M	A	M X A
SE $\bar{d}$	0.12	0.12	0.25
CD(P=0.05)	0.29	0.29	0.58

	Germination (%)				
M_1	60 (50.77)	43 (40.98)	23 (28.66)	42.0 (40.40)	72 (58.05)
M_2	64 (53.13)	47 (43.28)	25 (30.00)	45.3 (42.30)	74 (59.34)
M_3	66 (54.33)	50 (45.00)	34 (35.6)	45.6 (42.48)	76 (60.67)
Mean	63.3 (52.71)	46.6 (43.05)	27.3 (31.5)	44.3 (41.73)	74 (59.34)
M_0	55 (47.87)	41 (39.82)	21 (27.27)	39 (38.65)	71 (57.42)

	M	A	M x A
SE $\bar{d}$	1.346	1.346	2.69
CD(P=0.05)	3.1	3.1	6.26

Figures in paranthesis are arcsine transformed values

Table 34. **Effect of magnetic seed treatment on root length and shoot length (cm) in differentially aged seeds of brinjal cv.PKM 1**

Magnetic seed Treatment (M)	AGEING (A) (A_1)	(A_2)	(A_3)	Mean	(A_0)
Root Lenght (cm)					
M_1	4.5	4.4	4.2	4.36	4.6
M_2	4.5	4.5	4.3	4.43	4.7
M_3	4.7	4.5	4.4	4.53	4.8
Mean	4.56	4.46	4.30	4.44	4.70
M_0	4.5	4.3	3.7	4.17	4.6

	M	A	M x A
SE $\bar{d}$	0.114	0.114	0.228
CD(P=0.05)	0.26	0.26	0.56

Shoot length (cm)					
M_1	5.2	4.5	4.5	4.73	5.8
M_2	5.4	4.7	4.9	5.00	5.9
M_3	5.5	4.9	5.0	5.13	6.0
Mean	5.36	4.70	4.80	4.95	5.9
M_0	5.0	4.4	4.0	4.46	5.4

	M	A	M x A
SE $\bar{d}$	0.12	0.12	0.24
CD(P=0.05)	0.28	0.28	0.55

Table 35. Effect of magnetic seed treatment on vigour index and drymatter production (mg) in differentially aged seeds of brinjal cv. PKM 1

Magnetic seed Treatment (M)	AGEING (A) (A_1)	(A_2)	(A_3)	Mean	(A_0)
	Vigour index				
M_1	576	383	202	387.0	749
M_2	666	432	229	442.3	784
M_3	701	470	323	498.0	828
Mean	647.6	428.0	251.3	442.3	787
M_0	516	355	162	344.3	710

	M	A	M x A
SE $\bar{d}$	15.65	15.65	34.43
CD(P=0.05)	35.7	35.7	78.4

	Dry matter production (mg)				
M_1	1.26	1.08	1.00	1.11	1.29
M_2	1.30	1.10	1.03	1.14	1.33
M_3	1.35	1.15	1.10	1.20	1.38
Mean	1.30	1.11	1.04	1.15	1.33
M_0	1.22	0.95	0.86	1.01	1.25

	M	A	M x A
SE $\bar{d}$	0.024	0.024	0.06
CD(P=0.05)	0.05	0.05	0.14

4.6.3. Root length (cm)

The magnetic seeds treatments did not influence the non aged control seeds. However M_3 increased the root length of A_1 and A_2 to an extent of 6 per cent the control. Whereas, M_1, M_2 and M_3 increased the root length of A_3 to an extent of 12, 15 and 19 per cent respectively.

4.6.4. Shoot length (cm)

The shoot length of non aged seeds were not influenced by M_1 and M_2. However, M_3 increased the shoot length of non aged seeds to an extent of 12 per cent.

Among the differentially aged seeds A_1 and A_2 were not influenced by magnetic seeds treatments. However, the shoot length of A_3 was increased by M_1 , M_2 and M_3 to an extent of 14, 22 and 28 per cent respectively.

4.6.5. Vigour index

The increase in vigour index of non aged seeds by M_1 and M_2 were non significant whereas M_3 recorded an increase of 17 per cent.

The vigour index of mildly aged seeds was increased by M_2 and M_3 to an extent of 29 and 36 per cent respectively whereas M_1 was on par with control.

The vigour index of A_2 and A_3 was non influenced by M_1 and M_2. However, M_3 increased the vigour index of A_2 and A_3 to an extent of 32 and 99 per cent respectively.

4.6.6. Dry matter production (mg)

The magnetic seed treatments failed to increase the dry matter production of non aged control and mildly aged (A_1) seeds.

However, the dry matter production of A_2 was increased by M_2 and M_3 to an extent of 14 and 21 per cent and of A_3 was increased by M_1, M_2 and M_3 to an extent of 16, 20 and 28 per cent respectively.

4.7. Storage studies with pelleted seeds

Significant results were obtained between treatments, periods and their interaction for speed of germination, germination percentage, root length, shoot length and vigour index.

4.7.1. Speed of germination (Table 36)

The seeds treated with Captan and Vit E recorded an initial speed of germination of 12.6 and 20.2 respectively against 12.3 by untreated control.

Whereas, after 8 months of storage there was a reduction of 14, 27 and 17 per cent in the speed of germination of Captan, Vit E and control respectively.

However, at the end of eighth month, the speed of germination of Vit E treated seeds was significantly superior to the control followed by Captan treated seeds.

Among the seeds pelleted with different plant products, Arappu pelleted seeds recorded higher speed of germination followed by Pungam pelleted seeds.

The speed of germination of Pungam and Arappu pelleted seeds at the end of eighth month of storage recorded significantly higher speed of germination followed by Notchi, Neem and Acacia pelleting treatments.

4.7.2. Germination (%) (Table 37)

Table 36. Effect of seed treatment on speed of germination of brinjal cv. PKM 1 under storage

Treatment	Period of storage (P)					
	P_0	P_1	P_2	P_3	P_4	MEAN
Acacia	7.2	7.1	7.0	6.9	6.5	6.9
Arappu	12.0	11.3	11.2	11.1	10.5	11.2
Neem	8.8	8.4	8.3	8.0	7.8	8.3
Notchi	10.9	10.1	10.0	9.2	9.1	9.9
Pungam	11.4	10.9	10.5	10.5	9.9	10.6
Captan	12.6	12.5	11.9	11.0	10.8	11.8
Vit E	20.2	16.0	15.8	14.9	14.7	16.3
MEAN	11.9	10.9	10.7	10.2	9.9	10.7
Control	12.3	12.2	11.6	10.8	10.2	11.4

	T	P	TxP
SE $\bar{d}$	0.05	0.045	0.14
CD (P=0.05)	0.10	0.09	0.28

Table 37. **Effect of seed treatment on germination (%) of brinjal cv. PKM 1 under storage.**

Treatment	Period of storage (P)					
	P_0	P_1	P_2	P_3	P_4	MEAN
Acacia	57 (49.02)	56 (48.05)	54 (47.29)	51 (45.57)	49 (38.65)	53.4 (46.95)
Arappu	87 (68,87)	86 (68.03)	84 (66.42)	82 (64.90)	81 (64.16)	84.0 (66.42)
Neem	65 (53.73)	64 (53.13)	62 (51.94)	60 (50.77)	58 (49.60)	61.8 (51.83)
Notchi	67 (54.94)	66 (54.33)	65 (53.73)	62 (51.94)	60 (50.77)	64.0 (53.13)
Pungam	86 (68.03)	85 (67.21)	84 (66.42)	82 (64.90)	80 (63.43)	83.4 (65.96)
Captan	80 (63.43)	79 (62.73)	77 (61.34)	74 (59.34)	70 (56.79)	76.0 (60.67)
Vit E	91 (72.54)	90 (71.57)	88 (69.73)	84 (66.42)	82 (64.90)	87.4 (69.21)
MEAN	76.1 (60.67)	75.1 (60.07)	73.4 (58.95)	70.7 (57.23)	68.6 (55.92)	72.8 (58.56)
Control	75 (60.00)	74 (59.34)	72 (58.05)	70 (56.79)	64 (53.13)	71 (57.42)

	T	P	TxP
SE d	0.346	0.274	0.775
CD (P=0.05)	0.69	0.54	1.54

Figures in paranthesis are arcsine transformed values.

The untreated control recorded 75 and 64 per cent germination at initial and at the end of eighth month of storage indicating a reduction of 11 per cent germination over 8 months of storage period.

Among the treatments, irrespective of storage period, the highest percentage of germination was recorded by Vit E (87%) followed by Arappu (84%) pelleted seeds.

Among the treatments, Vit E, Arappu and Pungam maintained more than 70% germination even after 8 months of storage whereas the untreated control seeds maintained 70 per cent germination only upto 6 months.

4.7.3. Root and shoot length (cm) (Table 38 and 39)

The untreated control recorded 4.6 and 3.7 cm of root length and 5.1 and 4.0 cm of shoot length at the initial and 8 months after storage respectively.

Among the treatments, irrespective of storage period, Pungam and Vit E recorded highest root length of 4.7 cm against 4.3 cm in control. Whereas, Vit E and Arappu recorded increased shoot length of 5.4 cm against 4.6 cm in control.

The percentage reduction in root length between initial and 8 months after storage was minimum in Vit E (8%) followed by Pungam, Acacia, Notchi, Captan and Arappu (10 - 15%) and maximum in control (20%).

Whereas, the percentage reduction in the shoot length between initial and 8 months after storage was minimum in Vit E and Acacia (7 - 8%) followed by Arappu, Notchi, Pungam, Neem and Captan (11 - 13%) and maximum in control

Table 38. Effect of seed treatment on root length (cm) of brinjal cv. PKM 1 under storage

Treatment	Period of storage (P)					
	P_0	P_1	P_2	P_3	P_4	MEAN
Acacia	4.8	4.7	4.6	4.4	4.3	4.6
Arappu	4.9	4.7	4.6	4.3	4.2	4.5
Neem	4.8	4.6	4.4	4.2	4.1	4.4
Notchi	4.7	4.7	4.5	4.4	4.2	4.5
Pungam	4.9	4.8	4.8	4.6	4.4	4.7
Captan	4.6	4.6	4.5	4.3	4.0	4.4
Vit E	4.9	4.9	4.8	4.6	4.5	4.7
MEAN	4.8	4.7	4.6	4.4	4.2	4.5
Control	4.6	4.6	4.4	4.2	3.7	4.3

	T	P	TxP
SE $\bar{d}$	0.017	0.013	0.030
CD (P=0.05)	0.03	0.03	0.06

Table 39. Effect of seed treatment on shoot length (cm) of brinjal cv. PKM 1 under storage

Treatment	Period of storage (P)					
	P_0	P_1	P_2	P_3	P_4	MEAN
Acacia	5.2	5.2	5.0	5.0	4.8	5.0
Arappu	5.6	5.6	5.4	5.3	5.0	5.4
Neem	5.2	5.1	5.0	4.9	4.5	4.9
Notchi	5.3	5.3	4.9	4.9	4.7	5.0
Pungam	5.5	5.4	5.1	5.0	4.9	5.2
Captan	5.2	5.1	4.9	4.7	4.5	4.9
Vit E	5.6	5.5	5.3	5.3	5.2	5.4
MEAN	5.4	5.3	5.1	5.0	4.8	5.1
Control	5.1	4.8	4.6	4.3	4.0	4.6

	T	P	TxP
SE d	0.023	0.018	0.05
CD (P=0.05)	0.04	0.04	0.1

(22%).

4.7.4. Vigour index (Table 40)

The maximum vigour index was recorded by Vit E at initial (956) and eight months after storage (795) followed by Arappu and Pungam and minimum was recorded by Acacia at initial (576) and eight months after storage (446).

Significant reduction in vigour index was observed in untreated control to an extent of 32 per cent over a period of eight months storage.

However, the reduction in vigour index was only 17 per cent in Vit E and Pungam followed by rest of treatments (18-23%).

Table 40. Effect of seed treatment on vigour index of brinjal cv. PKM 1 under storage

Treatment	Period of storage (P)					
	P_0	P_1	P_2	P_3	P_4	MEAN
Acacia	576	554	518	479	446	515
Arappu	905	886	840	787	745	833
Neem	650	621	583	546	499	580
Notchi	670	660	611	577	534	610
Pungam	894	867	832	787	744	825
Captan	784	766	714	666	612	708
Vit E	956	770	889	832	795	848
MEAN	776	732	712	668	625	703
Control	728	696	648	595	493	612

	T	P	TxP
SE $\bar{d}$	6.87	5.43	15.36
CD (P=0.05)	14	11	30

DISCUSSION

CHAPTER V

DISCUSSION

At or shortly before harvest the seeds are considered to have maximum potential for survival. Henceforth, most seeds undergo certain irreversible changes that reduce survival capacity and leads to loss of vigour and viability i.e. lack of capacity to germinate and produce normal seedling called "deterioration" (Anderson, 1973).

Deterioration or degenerative process is inevitable in all forms of life which leads to death. Deterioration cannot be controlled/ stopped, however, can be slowed down provided if proper measures were taken earlier. This deterioration or degenerative process of seeds is influenced by a variety of factors or conditions.

Seed deterioration is one way different from the senescence of all other plant parts. When all other plant parts senesce they usually exhibit a distorted physical symptom in shape, structure, colour apart from physiological and anatomical degradations. On the other hand, seed during deterioration at various places of production, processing and storage may not exhibit a clear variation either in the size, shape, weight or some time colour also. However, there may be drastic deteriorative changes in the physiobiochemical status of the seed i.e., vigour, vitality and viability of seeds.

In the present investigation, an attempt was made to trace the pattern of deterioration of seed quality in brinjal cv. PKM1.

The percentage of germination with speed is an excellent indicator of growth potential of surviving seed irrespective of factors responsible for loss of viability (Abdalla and Roberts, 1969) and accelerated ageing was an excellent predictor of seed storability (Egli **et al.**, 1978).

The results revealed that, under accelerated ageing, seed lot with initial speed of germination of 6.53 was reduced to 5.5 and 3.8 after 10 and 16 days of accelerated ageing respectively. Further, the seed lot with initial germination per cent of 89 has lost 22, 44 and 71 per cent germinability within 6, 10 and 16 days after accelerated ageing. After 18 days of accelerated ageing, the seed lot lost its complete viability. The progressive fall in speed of germination was rightly coincided with the fall in per cent germination. Similar trends in the fall of germination speed and per cent germination was observed by Sundareswaran and Karivaratharaju (1994) in tomato and Viswanatha **et al.** (1994) in redgram under accelerated ageing.

The decline in germinability with period of storage could be due to ageing phenomena associated with irreversible physical, physiological and biochemical changes occurring inside the seed, accelerated by the fluctuation in RH and temperature of the storage environment (Woodstock and Combs, 1967; Abdul-Baki and Anderson, 1972 and Heydecker, 1972).

The seed lot with an initial root length of 4.55cm and shoot length of 6.00 cm showed a reduction of 13 and 23 per cent after 16 days of accelerated ageing. The results indicated that there was a progressive fall in the physiological stamina of deteriorating seed to produce root and shoot. Interestingly, the progressive fall of shoot length was found faster than the root length in brinjal. This was coincided with the results of Ravichandran and Thiagarajan (1994) in maize and groundnut.

Longer period of ageing resulted in higher decline in seedling length and also affected yield parameters (Wu, 1977 and Persis and Negi, 1983).

The results clearly indicated that under the accelerated ageing condition, reduction in root length was only to a maximum of 13 per cent till the complete loss of viability. So far as shoot length is concerned, 13 per cent reduction was reached within 11 days of accelerated ageing. This was in conformation with the findings of Chauhan **et al.** (1984), where, the prolonged ageing had a marked effect on shoot growth in case of barley and soybean though the root length was equally affected in both the crops. Similar trend was also observed by Purkar (1980) in wheat.

The present investigation clearly indicated the reliability of shoot length to predict the level of deterioration of seed lots.

In case of vigour index, 25, 50 and 75 per cent decline in initial vigour was noticed after 6, 8 and 14 days of accelerated ageing. The decline in vigour index was preceded the decline in germination at all levels of accelerated ageing i.e. when the germination reduction was 53 per cent, the reduction in vigour index was 65 per cent. This was in agreement with the findings of Ravichandran and Thiagarajan (1994) in groundnut and soybean.

The deterioration in the quantum of seedling dry matter production was continuous like germination. However, the reduction in dry matter production was only 12 per cent up to 10 th day and there after the reduction was as high as 38 per cent on 16 th day of accelerated ageing.

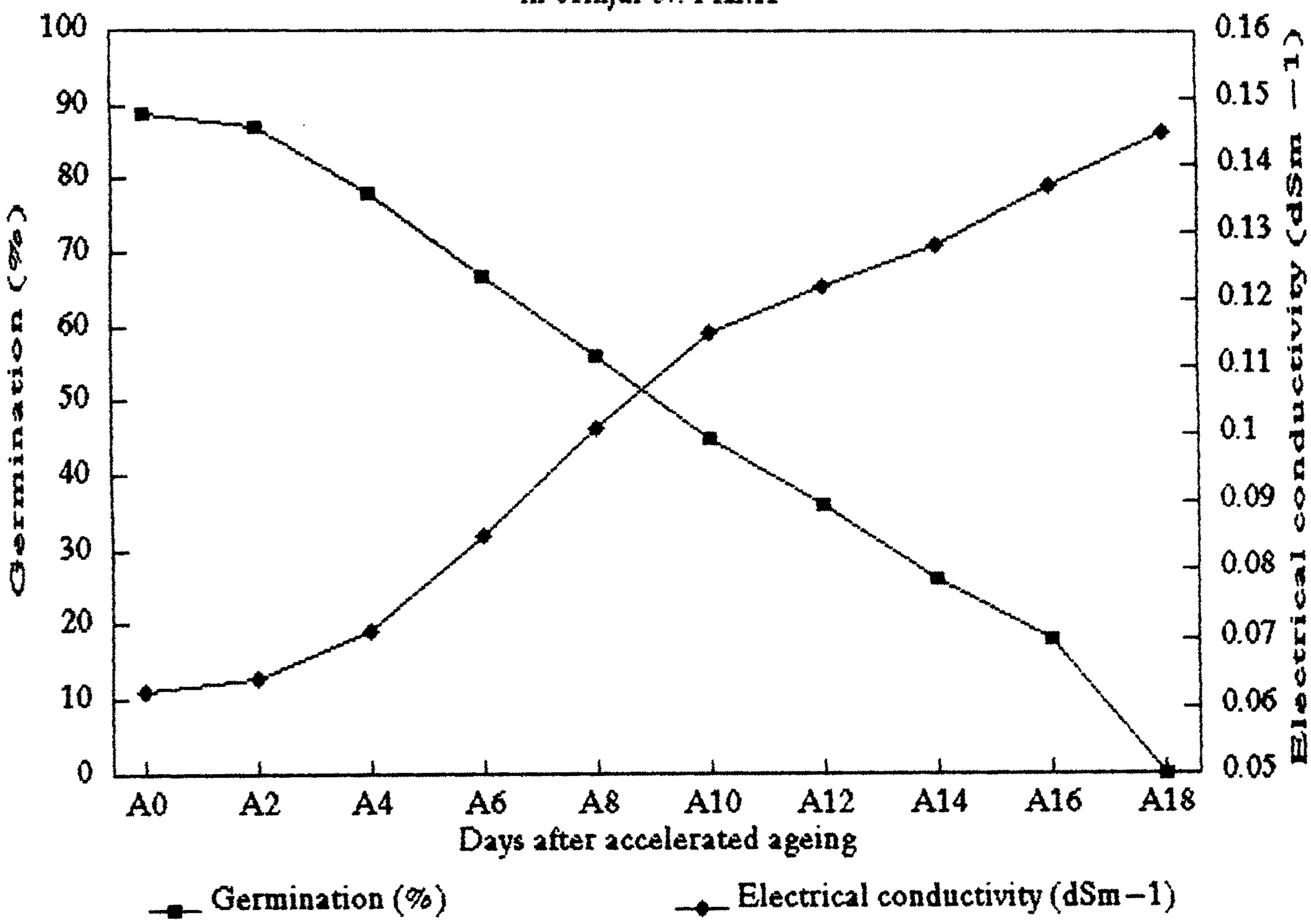
The most evident symptom of seed deterioration is the loss of germinability. This sign has been clearly reported on both aged and damaged seeds and has been associated with membrane deterioration, which play a vital role in the compartmentalization of cellular components, as reflected by ultrastructure studies and analyses of seed leachate in many species (Bewley, 1986; Fernandez Garcia de Castro and Martinez-Honduvilla, 1984; Powell, 1986; Priestley, 1986; Torres **et al.**, 1991). Differences in leakage measured by electrical conductivity of seed leachates have been found to be related with seed vigour. Faster the loss of integrity of the seed coat measured through the seed leachate, quicker the deterioration of vigour and viability of the seed.

The results obtained in this study for electrical conductivity are in good agreement with the observations reported previously by Powell and Mathews (1978) in peas, DePaula (1993) in sunflower and Sundareswaran and Karivaratha raju(1994) in tomato. Prolonged storage at high temperature and high humidity caused severe damage to brinjal seeds as evidenced by a complete loss of viability and an increase of EC values (Figure 1). The continuous and irreversible leakage observed in these seeds could be attributed to loss of membrane integrity. However, storage for 4 days under accelerated ageing did not affect drastically to brinjal seed as reflected by their viability. The continuation of a relatively high leakage throughout the accelerated ageing period is indicative of an increase in the proportion of deteriorated seeds, and is consistent with loss of membrane integrity.

Denaturation of protein is one another reason for deterioration of physiological vigour in the seed. Due to the reduction in synthetic and mobilisation efficiency the protein built up from other sources were restricted. In the present study, reduction in protein content was noticed with increasein ageing. However, the reduction in protein content was only 7 per cent when compared to the other physiological parameters. The decrease in protein content presumably might have resulted from protein degradation by protease (Ching and Schoolcraft, 1968). The decrease in protein content in onion under accelerated ageing condition was reported by Mary and Thiagarajan (1991).

Physiological deterioration of seed vigour might be the outcome of the deterioration of various levels in the enzyme activity and seed composition. Enzymes are considered to be the catalyst of all biochemical activities and any amount of reduction or retardation either in the quantity or activity of enzyme produced at various sites in the seed may

FIG. 1 The pattern of seed deterioration under accelerated ageing condition in brinjal cv. PKM1



reduce the synthesis of amino acid, nucleic acid and other valuable nutrient necessary for growth and development. Dehydrogenase enzyme is one of the many life supporting enzymes, the reduction of which reduce the viability of seed and seedling and the absence of it may cause death of the seed (Plate 2).

The environmental conditions which prevail while the seed on the mother plant or after detachment from mother plant dictates the subsequent germination behaviour of the seed. Even though, the temperature and relative humidity surrounding the mother plant or under storage favours the seed, there exists some physiological heterogeneity in the viability and vigour of the seeds in a seed lot. The individual seed in a seed lot may undergo differential ageing depending up-on the inherent vigour of the individual seed. Hence, creation of required favourable conditions to differentially aged seeds to the maximum possible extent to protect the seed from harmful pathogens is a must (Wieser, 1976; Vartha and Clifford, 1973).

In the present investigation, an attempt was made to see the effect of pre-sowing treatments to improve the differentially aged seeds of brinjal. After, creating differential ageing (A_0, A_1, A_2 and A_3), the seeds were pelleted with indigenous plant products of Acacia (**Acacia nilotica** L.), Arappu (**Albizia amara** L.), Neem (**Azardirachta indica** L.), Notchi (**Vitex negunda** L.) and Pungam (**Derris indica** L), primed with Vit E, $CaCl_2$ and water and dry dressed with Captan.

PLATE 2a. Pattern of Tetrazolium staining of seed embryos after 0 days accelerated ageing of brinjal cv. PKM 1

PLATE 2b. Pattern of Tetrazolium staining of seed embryos after 6 days accelerated ageing of brinjal cv. PKM 1

2c. Pattern of Tetrazolium staining of seed embryos after 10 days accelerated ageing of brinjal cv. PKM 1

PLATE 2d. Pattern of Tetrazolium staining of seed embryos after 14 days accelerated ageing of brinjal cv. PKM 1

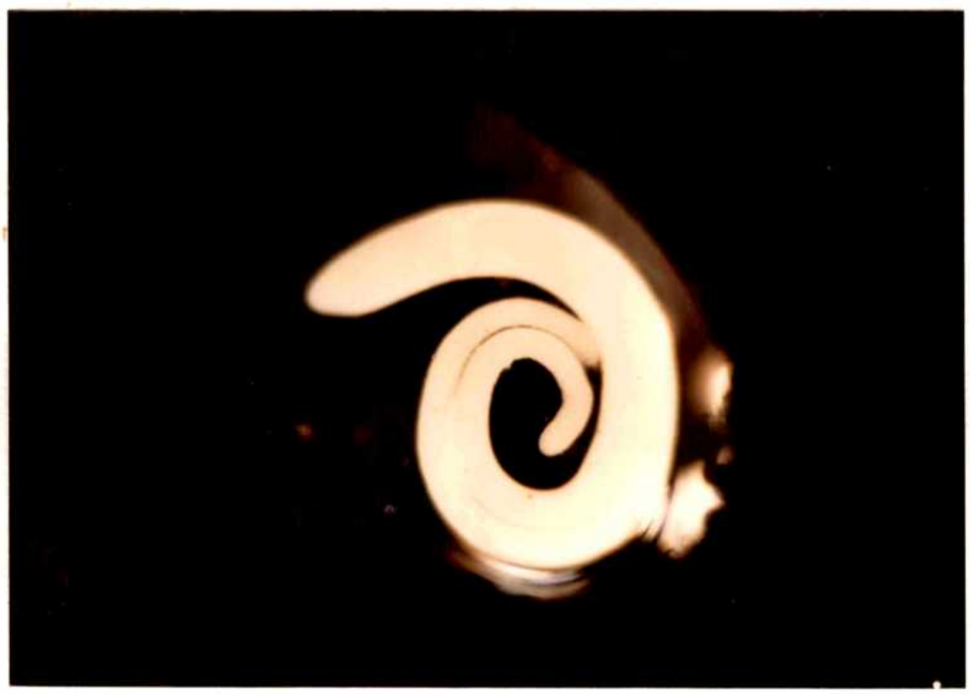


PLATE 2e. Pattern of Tetrazolium staining of seed embryos after 18 days accelerated ageing of brinjal cv. PKM 1

Plant products with the help of certain nutrient ingredients could be able to correct certain physiological disorders and repair damage encountered due to differential ageing associated with seed thereby facilitating better emergence than the unpelleted seed (Prasad, 1994).

Pelleting can be effectively used in improving the planting value of small and less vigorous seeds (Subba Rao, 1984). The property of pelleting material such as porous nature to movement of air to the seed and weaken or breakdown easily when coming into contact with soil moisture to prevent any physical impedance to germination and non-toxicity might be the reason for the better performance of pelleted seeds than unpelleted seeds.

The results revealed that hydration-dehydration (H-DH) treatment showed increased speed of germination in all age groups. There was a clear contrast between germination speed and totality of germination in field so far as mere hydration and dehydration was concerned. Probable reason might be that water content like any other solute might have hastened the germination speed of these seeds which were already with higher vigour potential. However, when totality of germination was concerned, the Vit E in aqueous solution invigourated the low vigour seeds which resulted in better germination per cent than mere hydration-dehydration.

Rapid seedling emergence has been found to be associated with seedling establishment and early maturity which in turn contributes favourably to high yield under drought conditions, because the plant completes its life cycle before the onset of drought (Gupta, 1985).

Under laboratory conditions, Arappu showed remarkable increase in germination of non aged and mildly aged seeds over the respective controls, but failed to improve moderately and severely aged seeds. Whereas, Vit E, Hy-dehydration and $CaCl_2$, though next to Arappu in nonaged and mildly aged seeds, showed steady increase in all age groups over the respective controls.

On the contrary to the above, under field test conditions, Notchi, Vit E and Pungam demonstrated its superiority to promote germination in all age groups over the controls as well as to other treatments.

On the other hand, Acacia and Neem pelleted seeds did not remarkably affect the germination in the field condition, but rather negatively affected the process under laboratory conditions. However, the same treatments showed slight positive influence on germination when sown directly in the field. These results were in conformity with the report of Puls and Lambeth (1974), who reported an increase in germination of aged tomato seeds treated by GA_3 + Kinetin + KNO_3. Kinetin plays an important role in directing the transport of amino acids and in inducing protein and RNA synthesis (Davis and Cocking, 1967).

The results also revealed that the Arappu pelleting which was able to improve non aged and mildly aged seeds, failed to improve the moderately and severely aged seeds. Whereas, Vit E and Pungam treatments, which were not able to improve non aged and mildly aged seeds, could able to improve moderately and severely aged seeds.

The reason could be attributed to as Arappu possessess saponins which acts as growth promotors like GA and thus improves the germination of reasonably healthy seed as a result of the stimulation of enzyme synthesis and activation of ribonuclease activity. Whereas, the Notchi and Vit E treatments failed in further improvement of non aged seeds but able to nullify the ageing effect even when the seeds were severely aged. The reason could be attributed as Vit E and Notchi possesses antioxidant properties which reduced the activity of lipid peroxidation in aged seeds there by increasing enzyme activity in the germinating seeds. The same views was expressed by Demir **et al**. (1993) and Geetha and Shyamala Devi (1993).

Similar beneficial effects on storability was obtained when parsley and onion seeds treated with tocopherol (Woodstock **et al**. 1983). Sabir-Ahamed and Thiagarajan (1989) proved beyond doubt the remarkable control of Notchi leaf powder over the process of deterioration of soybean.

Naturally aged seeds due to the insufficient synthetic and mobilization efficiency in consequence of reduction in enzymatic activity, the root and shoot length and dry mater production would be reduced.

In the present investigation, Vit E, $CaCl_2$ and Notchi improved the root length of all levels of ageing. Whereas, Pungam, though failed to improve in non aged and mildly aged seed progenies, remarkably increased the root length in severely aged seeds followed by moderately aged seed progenies. Interestingly, Pungam showed its superiority in increasing the shoot length at all levels of ageing than any other treatment. However, Vit E and Notchi continued to improve the shoot length with simultaneous increase in root length. All other treatments exhibited minimum improvement over the control. The results were in contrast with the findings of Demir (1994) who reported increased germination percentage of naturally aged tomato seeds of 2 and 5 years with GA and KNO_3 but without any increase in root or shoot length of respective controls.

Seedling dry matter production is the best parameter to measure the relative efficiency of different kinds of seed lot. Since, the seedling dry weight indicates the ability of seeds to convert its dry weight into seedling dry matter production with in a unit time, more the quantity of seedling dry matter by weight more will be treatmental effect on the quality of seed.

The present study demonstrated the ability of Pungam, Vit E, Acacia and Neem to improve the seedling dry weight in non aged and differentially aged seeds over the respective controls.

Similar increased trend in seedling dry weight, when seeds treated with Notchi, Acacia and Vit E in maize; Arappu, Pungam and Vit E in Groundnut; and Arappu and Notchi in soybean, was observed and reported by Ravichandran and Thiagarajan (1994).

The computed vigour index would be at its maximum where the germinability and seedling length were high, since it is the multiplied product of both.

All the treatments except Acacia and Neem demonstrated excellent vigour in all the age groups over the respective controls. However, Vit E and $CaCl_2$ exhibited its superiority under laboratory conditions. These results are in good agreement with the works of Sabir Ahamed and Thiagarajan (1989) who reported Vit E as good antioxidant and thus improves the shelf life of soybean seeds.

Direct seeding is now comparatively cheaper than transplanting and this is the first practical advantage noticed by farmers. Priming tomato seeds has resulted in improved germination or emergence as compared with non treated seeds when sown directly (Alvarado et al., 1987). However, emergence differed minimally between treated and untreated tomato seeds sown in the field (Ghate and Phatak, 1982). Emergence and earlier yield advantages were maintained for primed tomato seeds (Leskovar and Sims, 1987).

The marketable yields obtained from direct seeded crop was similar to that obtained by transplanting, which suggests the adoption of this method to reduce the costs incurred during raising of seedlings in nurseries and labour cost involved in transplanting of seedlings in the field.

Hence, in the present investigation, an attempt was made to see the efficacy of direct seeding of pelleted, primed and untreated differentially aged seeds of brinjal cv.PKM1.

Primed and pelleted seeds demonstrated its ability to promote the field emergence and yield parameters over Captan and untreated seeds at all levels of ageing.

All the treatments demonstrated their ability to increase plant height of brinjal with an exception of Neem in non aged seed progenies, and Acacia and Hy-dehydration treatment in differentially aged seed progenies. The results of the present study revealed that the pelleting and priming treatments were equally contributed to increase leaf area along with the increase in plant height.

Chacko et al. (1982) observed and reported that in fruit crops leaf area and fruit ratio determines the size and quality of fruits. And also they worked out the optimum leaf number and area required for the development of individual fruit and noticed that as leaf area increased fruit weight also increased.

Ageing induced reduction in the plant height of aged seed progenies when compared to non aged seed progenies. The degree of reduction in plant height rely on the intensity of ageing. Although, the decreased plant height did not result in the reduction of number of nodes and the leaves, there was a nodal congestion due to short internodes with same number of leaves which led to insufficient space for the production of flower buds, flower setting and development of fruits. Further, the nodal congestion led to shading thereby induced flower shedding.

Thus, the nodal congestion can affect the plant architecture, which in turn not only affect yield and quality parameters such as fruit length, fruit diameter, fruit volume, fruit yield, seed yield, seed number, fruit to seed ratio and earliness (Carette and Laurent, 1989) but also leads to confusion to misunderstand as off-type, and pave a way for rejection of seed plot under certification.

Whereas, when the aged seeds were treated with Vit E and pelleted with notchi the ill effects of ageing was reduced considerably.

Eventhough the population was made good by putting more number of seeds per hill in differentially aged seed progenies, there was considerable reduction in the fruit and seed yield to an extent of 7 to 37 per cent from the aged seed progenies when compared to non aged seed progenies.

However, almost all plant products and Vit E helped the aged seed progenies to reduce the loss in seed yield due to ageing to a certain extent indicating that these products might possess certain products which induce early vigour.

In certain cases Vit E treated mildly aged seed progenies registered higher seed yield than the non aged Vit E treated seed progenies.

Ageing depending upon the severity and duration, can cause changes in the morphophysiological characters of the progeny in the first generation itself (Chauhan and Banarjee, 1983). If the deterioration had gone beyond certain level it can cause minor genetic variations, chromosomal aberrations and characteristic mutations (Roberts, d1978; Purkar and Banarjee, 1979 and Chauhan and Swaminathan, 1984). The effect will be phenotypically visible only in the subsequent generation.

If so happens in the seed production that even if the seeds are produced with 100 per cent genetic purity and stored for a prolonged period, under unfavourable conditions the deterioration was fast and drastic. If such seeds are sown in the next generation there may be number of off-types inspite of proper presowing care taken on the seed.

It was surprising to note that while the ageing stress created much reduction in the physiological and biochemical parameters in the source seeds of brinjal, the same were not carried over to the subsequent resultant seeds. Moreover, the vigour of resultant seeds found to be more when compared to the source seed.

In the present investigation, when the resultant seeds of severely aged seed progenies were germinated in sand media under lab condition the seedlings exhibited tricotyledonous nature to an extent of 2-3 percent. This is a clear evidence for the carry over of the ageing induced variations to the subsequent generations indicating that severe ageing on seeds can effect chromosomal aberrations of various degrees (Plate 3). Occurance of tricotyly was observed by Sethumadhavan and Gopalkumar (1976) and a single aberrant egg plant seedling with variegated leaves amongst a mass of normal seedlings was also observed by Sambandam (1974).

Study on the seed-soil-water relationship is one of the neglected area in seed science and technology throughout the world. Many times the laboratory germination

Brinjal seedlings showing split in cotyledons, tricotyly and normal seedlings in aged seed progenies of resultant seeds.

reported by the seed resting laboratory did not agree with the field germination. The seed lots which could perform better in laboratory test in artificial media miserably fail when it is sown in the soil due to the inability of the seed to establish better seed-soil-water relationship due to stresses in the soil.

In the present investigation, an attempt has been made to know the influence of water holding capcity of different soils on germination and seedling vigour of treated and untreated seeds.

Water is pervasively involved in the life cycle of seeds. Water uptake in seeds is the first step towards germination. Water is essential to change the status of seed development from quiescence to active growth (Taylor **et al.**, 1992).

Stand establishment of a crop is influenced by the interaction of seed quality, seed-soil-water relations, and growing-media environment.

Various environmental stresses encountered after sowing may decrease or even prevent seedling establishment. Low temperature combined with excess soil moisture may decrease the germination and subsequent establishments. The influence of these detrimental environmental conditions on stand establishment becomes even more pronounced when the seeds are of suboptimal in quality.

Hence, in the present study, seeds were pelleted with Acacia, Arappu, Neem, Notchi and Pungam tree leaf powders, and primed in Vit C 1% , Vit E 1% and water and sown in block and red soils having 30, 40, 60, 80 and 100 per cent water holding capacities.

The results revealed that 40 to 60 per cent water holding capcity were optimum for greater speed of germination regardless of soil type and treatments. Any decrease beyond 40 per cent and any increase above 60 per cent water holding capcity resulted in drastic change in speed of germination along with per cent germination.

Vit C, Vit E and Pungam treatments exhibited its maximum ability on speed of germination at 40 per cent water holding capcity both in red and black soil followed by 60 per cent compared to control.

The similar results reported by Darby (1976) in celery where primed seeds showed 50 per cent germination in about 48 hours compared with nearly 10 days for a similar germination of unprimed seeds.

In the present investigation, the untreated seeds of brinjal recorded standard germination percentage only at 40 and 60 per cent water holding capacities. Whereas, the same untreated seeds failed to register minimum germination at 30, 80 and 100 per cent water holding capacities regardless of soil type.

However, earlier reports suggested 60 to 80 per cent for green gram, soybean, red gram, sunflower, ground nut and cotton (Balaji and Thiagarajan, 1990) and 60 per cent for onion, lablab and bhendi (Mary and Thiagarajan, 1994).

The study revealed that priming and pelleting treatments responded better at all water holding capacities

FIG. 2 Influence of water holding capacity and seed treatment on germination (%) of brinjal cv. PKM 1 in black soil

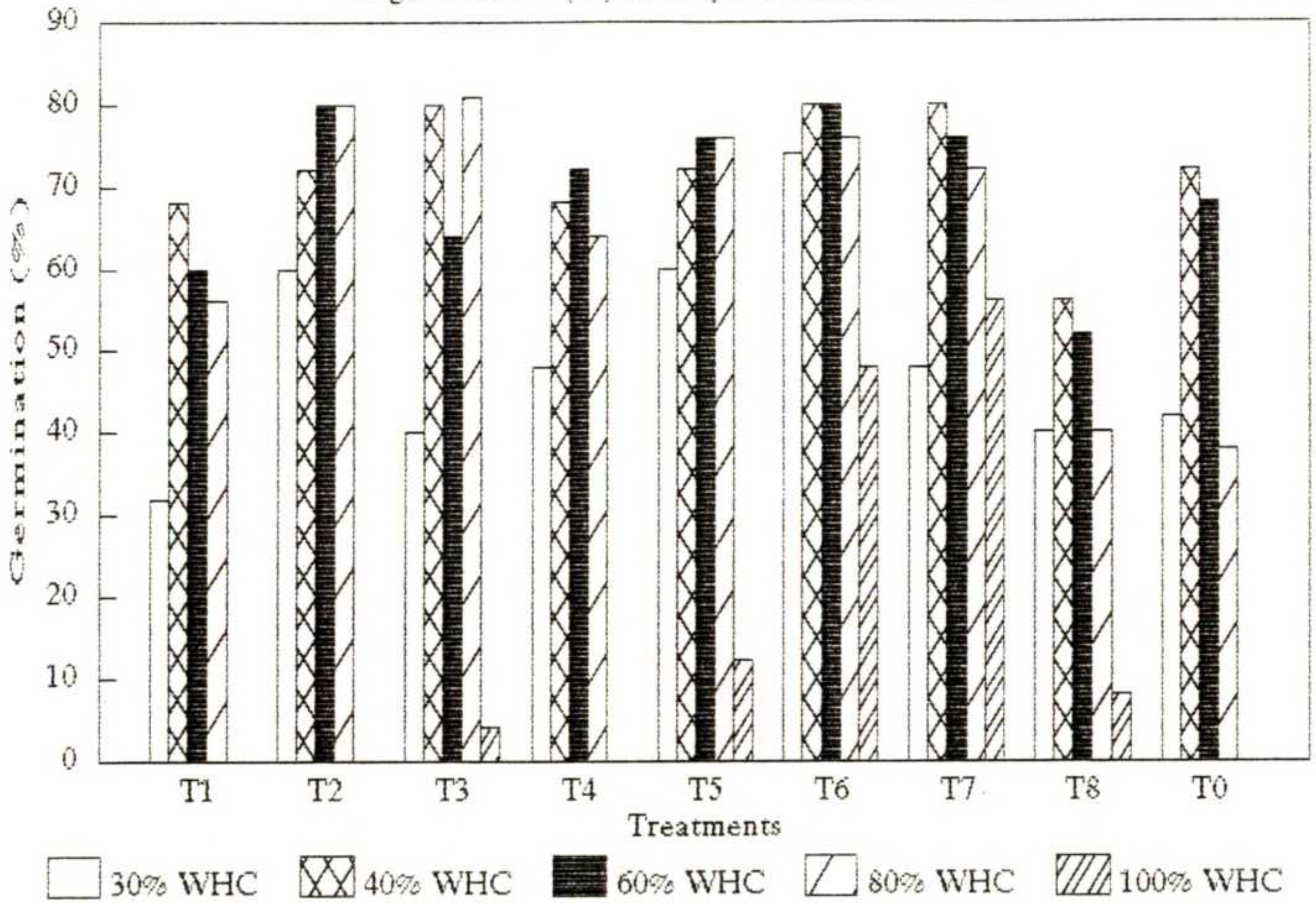
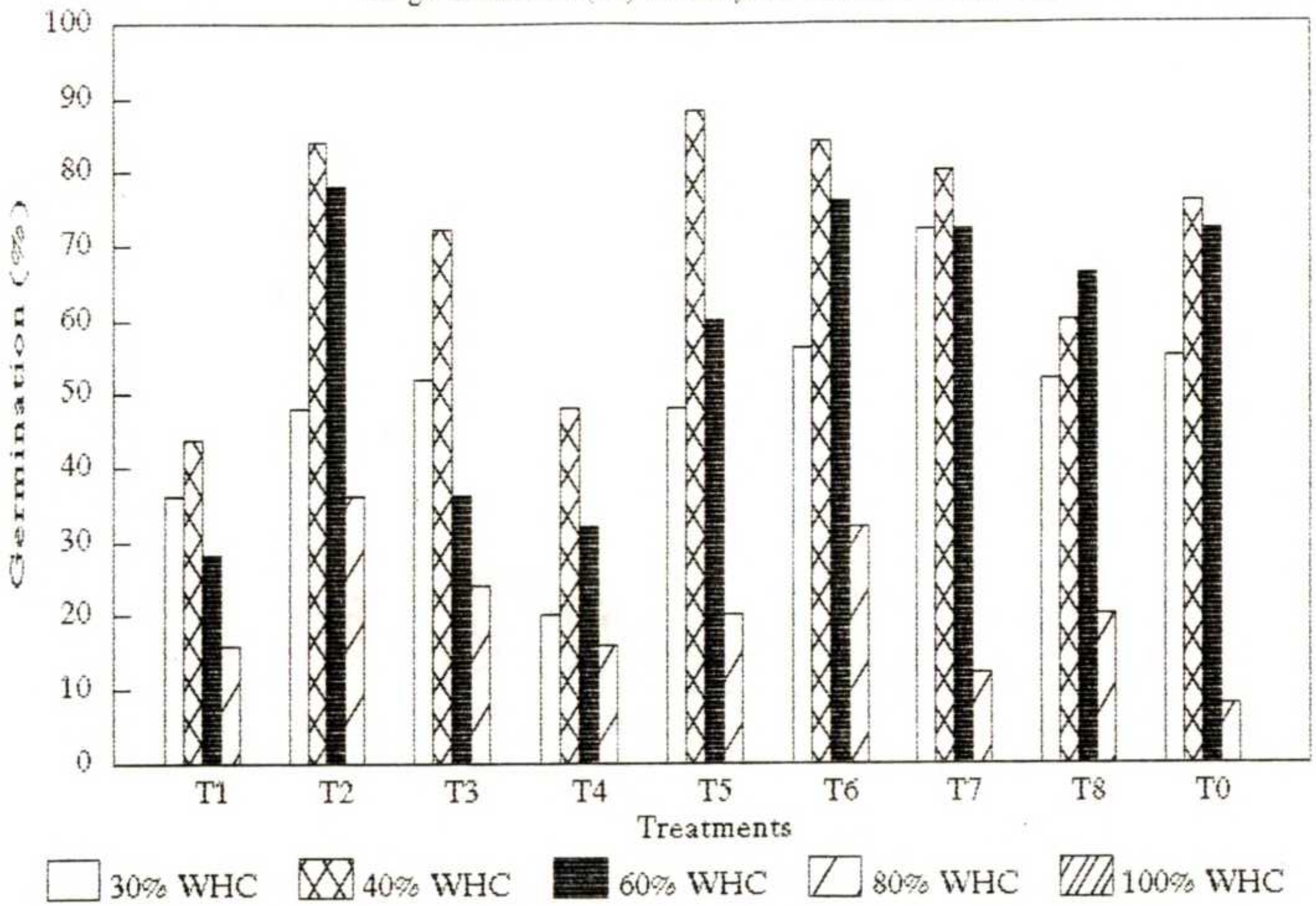


FIG. 3 Influence of water holding capacity and seed treatment on germination (%) of brinjal cv. PKM 1 in red soil



compared to control seeds. However, at 100 per cent water holding capacity all the treatments failed to induce germination in red soil (Plate 4a). However, in black soil pungam pelleted and Vit C and Vit A treated seeds germinated to an extent of 12, 48 and 56 per cent respectively (Plate 4b). Under 100 per cent water holding capacity ~~indicated that~~ the pelleting products can induce tolerance to seed to resist chilling and asphyxiation effect.

The results also revealed that above 60 per cent water holding capacity the untreated brinjal seeds miserably failed to germinate regardless of soil type. One of the reasons could be probably be imbibitional chilling injury. Imbibitional chilling injury is a physiological disorder that occurs in warm-season crops that originate from tropical or subtropical regions (Lyons, 1973). Rao and Gupta (1976) also reported the reason for failure of germination at supra-optimal condition might be due to asphyxiation.

The reason for poor germination and establishment of untreated seeds at 30 per cent water holding capacity could be due to the insufficient available soil moisture and soil crust formation in both red and black soil. These results and views confirmed the reports of Kretschmer, 1994.

Similar studies on snap beans revealed that a decline in the per cent germination with increased hydration rate (Wolk, 1988).

Rajput and Sastri (1985) reported similar findings in sorghum where seedling emergence was practically absent due to water logging for five days immediately after sowing.

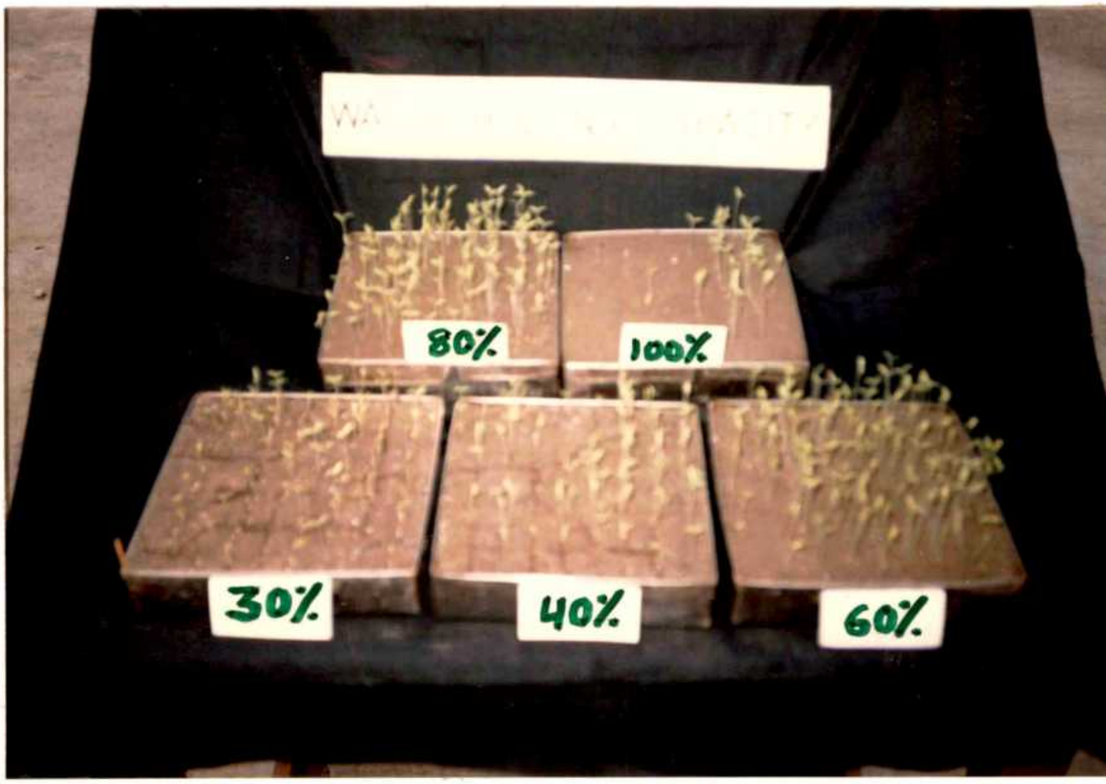


PLATE 4a. Influence of different water holding capacity of black soil on germination (%) in treated and untreated seeds of brinjal cv. PKM 1

PLATE 4b. Influence of different water holding capacity of red soil on germination (%) in treated and untreated seeds of brinjal cv. PKM 1

FIG. 4 Influence of water holding capacity and seed treatment on root length (cm) of brinjal cv. PKM 1 in black soil

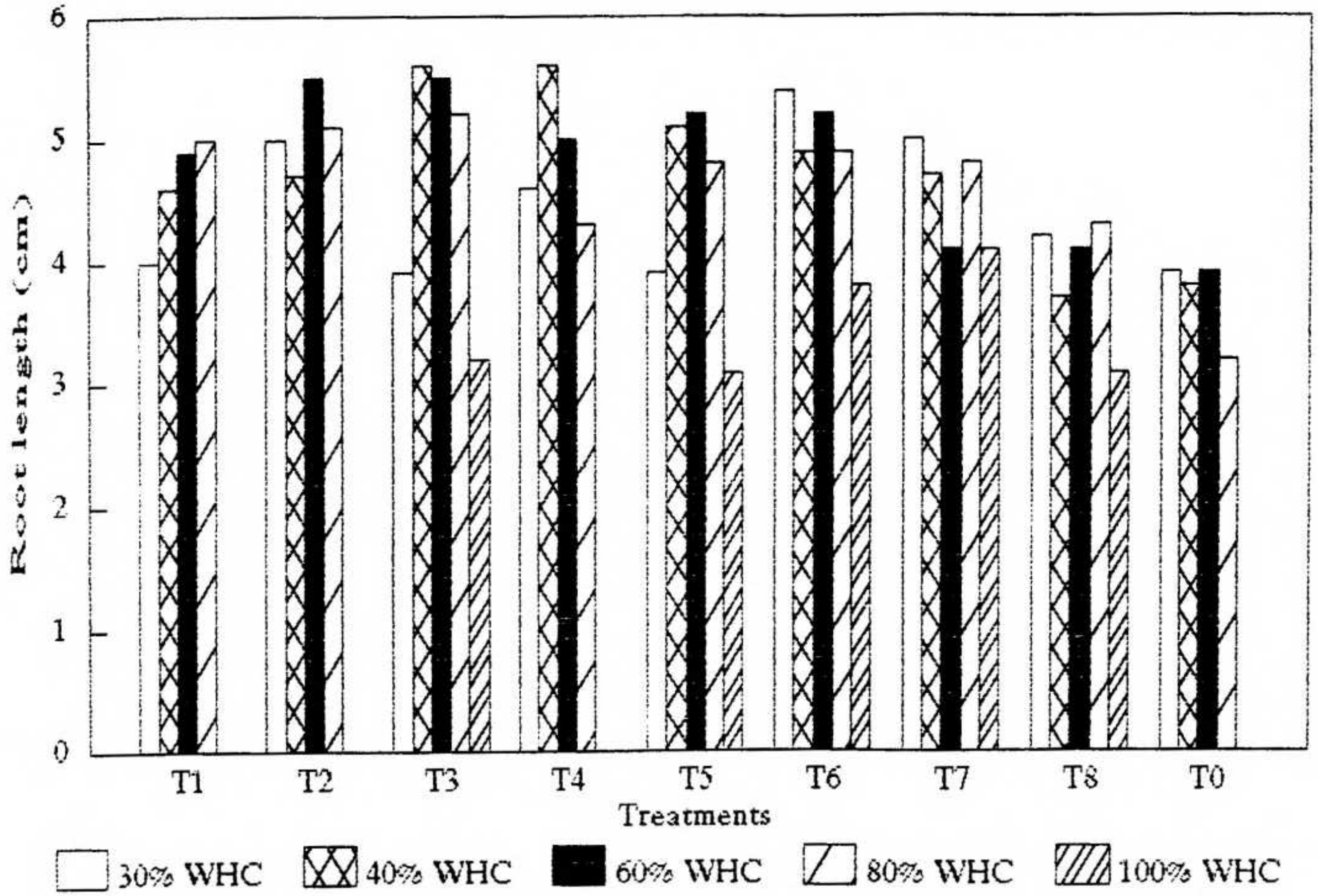
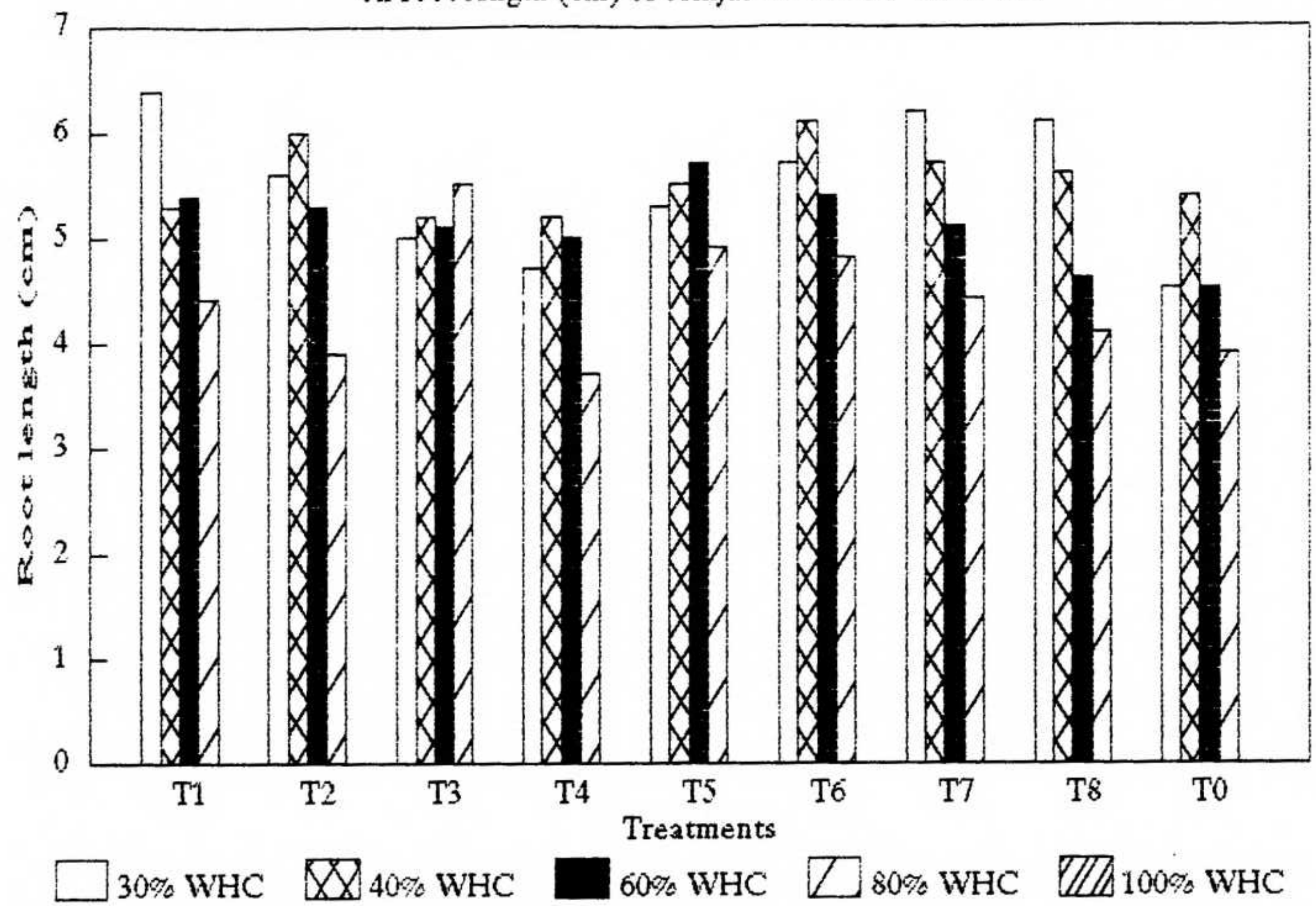


FIG. 5 Influence of water holding capacity and seed treatment on root length (cm) of brinjal cv. PKM 1 in red soil



Rao and Gupta (1976) reported that restricted respiration of seeds owing to water logging condition coupled with microbial rotting of seeds was the reason for poor establishment of soybean seeds.

In the present study, seeds pretreated with Vit C, Vit E and water were able to establish even under extreme chilling stress that is at 100 per cent water holding capacity.

The present study also revealed that pelleting treatments performed better than controls even under extreme stress conditions. This might be due to precise control of the water supply to each individual seed in order to achieve and maintain the desired water potential, the maintenance of an adequate oxygen supply to each seed, maintenance of the desired temperature and preventing colonisation by hostile microflora (Heydecker and Coolbear, 1977).

The present study revealed that root length was increased at sub optimal water holding capacity especially in red soil compared to other quality parameters. The increased root length might be due to the insufficient availability of soil moisture at root zone and thus extended its root in search of water for survival.

Whereas, the root length was decreased at 80 and 100 per cent water holding capacity compared to 40 and 60 per cent water holding capacities. This might be due to higher availability of moisture at root zone itself and the energy required for elongation of root might have been spent for increased shoot length which was evident from the results.

FIG. 6 Influence of water holding capacity and seed treatment on shoot length (cm) of brinjal cv. PKM 1 in black soil

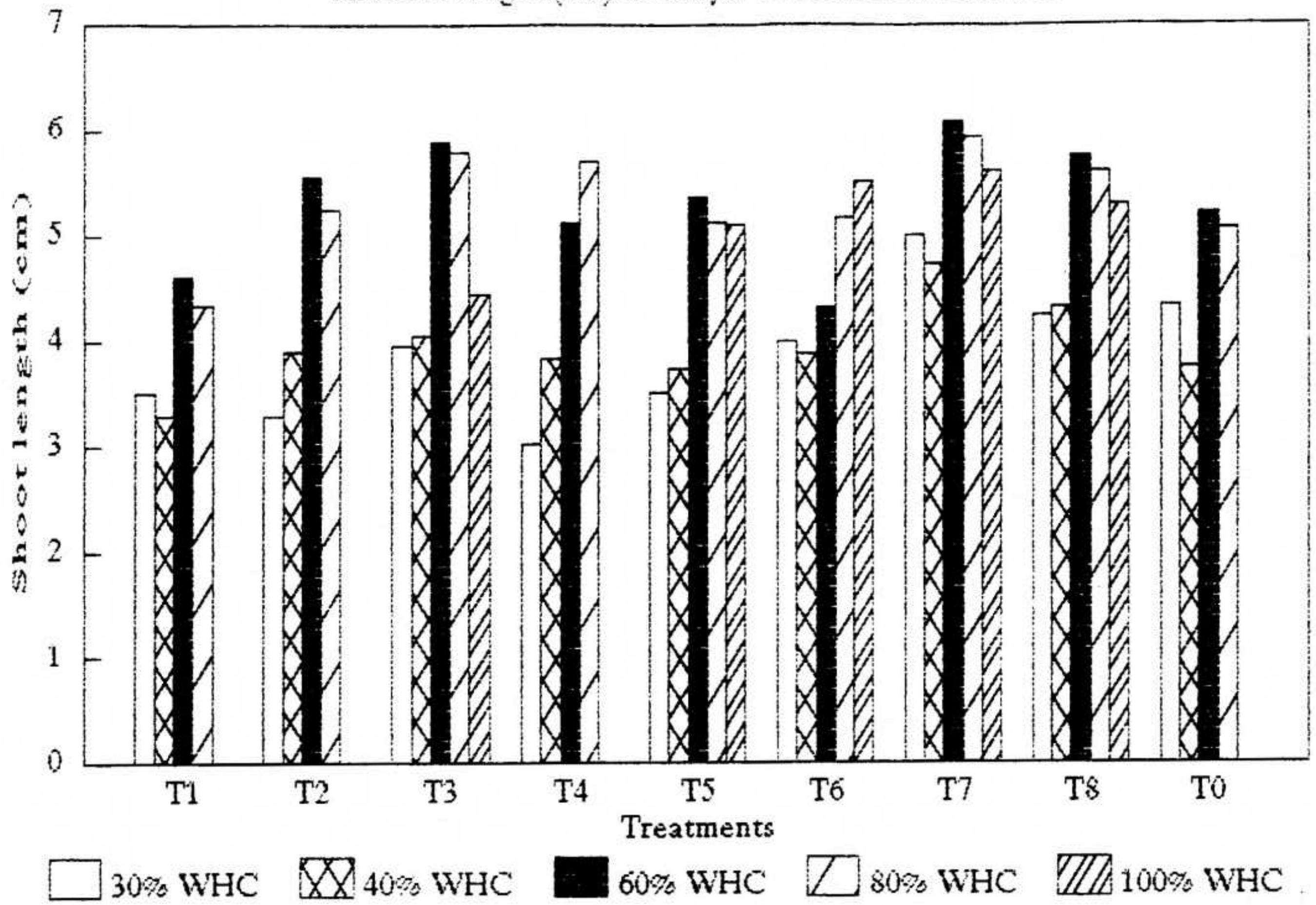
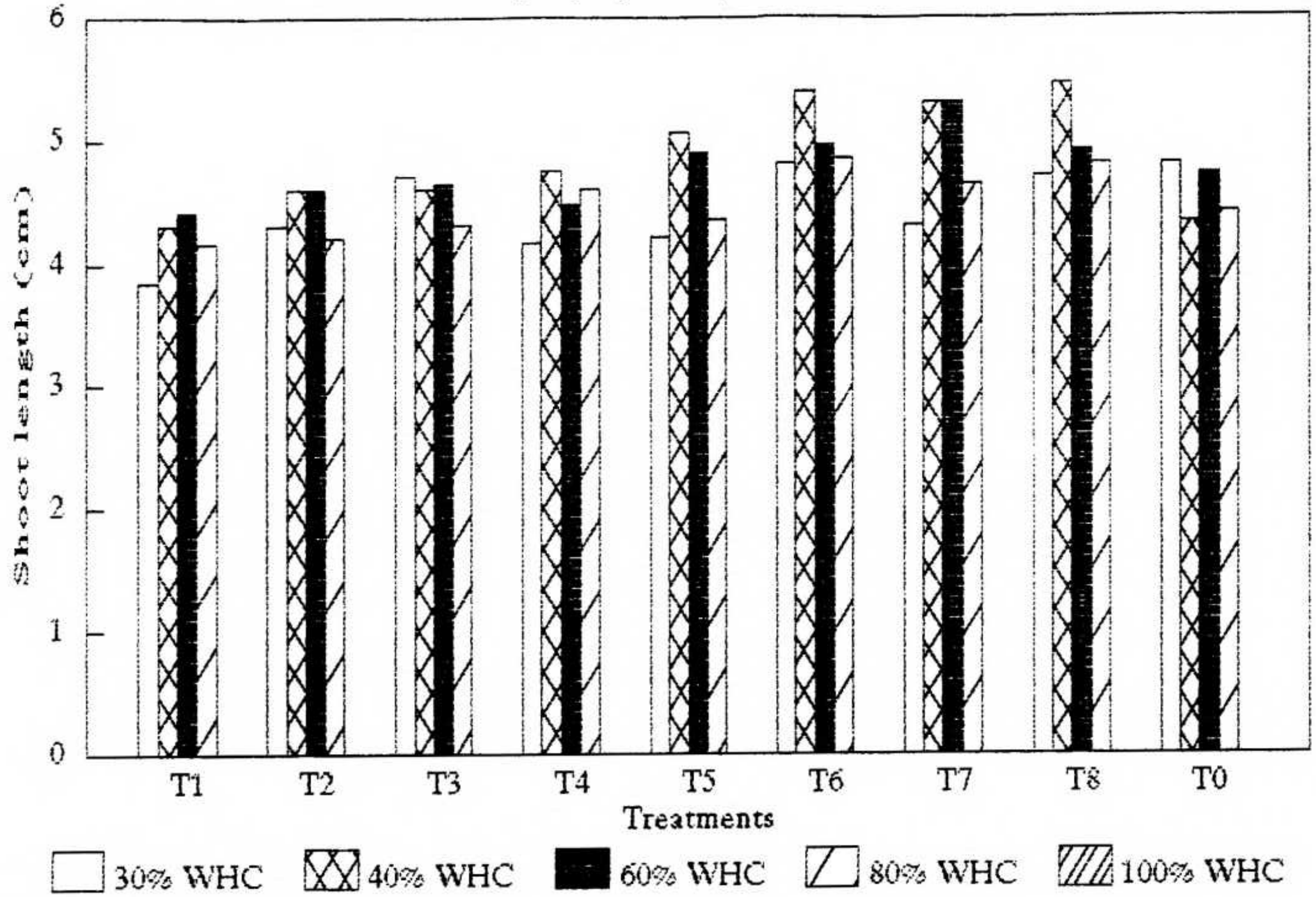


FIG. 7 Influence of water holding capacity and seed treatment on shoot length (cm) of brinjal cv. PKM 1 in red soil



The results were rightly coincided with the reports of Vertucci (1989) who observed increased hydration rate resulted in a linear decrease in radicle length of soybean seeds. Similar studies on snap beans revealed the same relationship, a decline in the per cent germination with increased hydration rate (Wolk, 1988).

Almost all the treatments increased root and shoot length along with the increase in dry matter production. It showed that pelleting materials, Vit C and Vit E facilitated multiplication and elongation of cells in shoot region to capture light in a competitive situation. The same findings were also reported in tomato (Nargis, 1995).

The accumulation of dry matter indicated the uninterrupted absorption of nutrients and better establishment of aerial shoot. The role of plant products, Vit C and Vit E in increasing dry matter production might be due to faster rate of emergence, utilization of earlier available conducive soil reactions and thus escaping from anticipated environmental stresses subsequently. Similar views also expressed by Tarakanov et al. (1977) where pelleted seeds of tomato nullified the adverse effects of high soil moisture.

The present experiment revealed that the high influence of the soil water holding capacity on the emergence of brinjal seeds demonstrated the necessity for an exactly calculated irrigation schedule. Depended on the matrix potential of the surrounding substrate and the matrix potential of the seed, the imbibition and the following metabolic processes will start (Kretschmer, 1994). Several environmental agents, such as sun light and vitamins, have qualitatively different effects on organisms at high and low doses. The enhancement of a desirable biological process by the administration of low doses of an otherwise toxic agent is called hormesis and a considerable body of evidence indicated that low dose radiation (LDR) may have hormetic effects.

Early reports suggesting hormetic effects were dismissed as statistical flukes. Recently, however, experiments have indicated two possible mechanisms for radiation hormesis, the enhancement of cellular DNA repair and the stimulation of an organisms immune system.

The existance of hormesis does not necessarily mean that the destructive effects of radiation just disappear at low doses, rather, these are probably process in which LDR may damage some cells while stimulating to others (THE HINDU daily April 20, 1994).

The stimulatory effects of radiation on seeds are, conflicting and often difficult to interpret, but there is less argument about the effect of high doses radiation. Much research after World war II was concerned with such aspects in order to provide guidannce in civil defence planning in the event of nuclear war (McKelvie, 1977). Sparrow **et al.** (1971) in the USA and Davis (1968, 1970 and 1973) in the United Kingdom have presented evidence concerning the radio-sensitivity of the major temperate crops.

Exposure of plants to ionizing radiations, or pre-sowing irradiation of seeds may induce cytological, morpho-genetical, biochemical and physiological changes in cells and tissues (Gunckel and Sparrow, 1961). Inactivation of enzymes, damage to chromosomes, nucleic acids, carbohydrates and other macromolecules are well known (Casarette, 1968).

Presowing irradiation of seeds generally does not have favourable effects on germination and subsequent growth and development of plants (Ravindranath, 1981). However, in certain cases when seeds soaked in chemicals prior to irradiation treatment the chemicals acts as radiomimictic and said to be stimulatory to seed germination.

In the recent past, the plant breeders recognized, under certain circumstances, mutation breeding as a highly potent means to obtain useful mutants in shortest time (Singh and Paliwal, 1987).

Hence, here an attempt was made to know the influence of water and Vit C as pre-irradiation treatment on germination and vigour of brinjal cv. PKM1.

Treated (Vit C and H-DH) and untreated (dry) seeds were subjected to different doses of ^{60}Co gamma radiation. The results revealed that there was a reduction in speed of germination and germination percentage when dry seeds subjected to gamma radiation at 30 Kr. The results were coincided with the findings of Sen and Ghosh (1968) who reported delayed germination as an effect of gamma irradiation in the seeds of **Corchorus** sp. Inhibitory effect of gamma rays on seed germination has been reported by many workers (Bowen and Thick, 1961; Saric **et al.**, 1961) who observed a linear relationship between the percentage of germination and dose rate.

Hydrated-dehydrated seeds when subjected to gamma radiation, the speed of germination at 20 and 30 Kr, and germination per cent at 10, 20 and 30 Kr reduced miserably. Conger (1972) mentioned that pre and post irradiation seed moisture content and Oxygen level were the two main factors affecting radio-sensitivity of seeds. At certain moisture levels a small change in moisture can cause large changes in radio sensitivity.

Vit C treated seeds ~~maintained its~~ speed of germination and the percentage germination was improved at 10 Kr to an extent of 8 per cent over the control.

Dry seeds showed considerable reduction in shoot length at 20 and 30 Kr. Whereas, hydrated-dehydrated seeds showed drastic reduction in shoot length as well as root length.

Lea (1955) suggested that uneven damage to meristematic cells due to genetic injuries might be the cause of such an irradiation response. Both chromosomal damage and mitotic inhibition were generally considered as the primary factors contributing to reduced shoot growth.

Similar trends were observed by Patel and Shaw (1974), while studying the effect of gamma irradiation (10,20 and 30 Kr) on **Solanum melongena** and **Capsicum annuum**, reported retardation in seed germination and development of seedling.

Vit C treatment improved the root length at 10 Kr. The results revealed that when hy-dehydration (T_1) and control (T_0) showed negative effect on seed vigour and other quality parameters, it was Vit C (T_2) which acted as radio-protective compound and improved the seed vigour to an extent of 21 per cent at 10 Kr and protected from radiation damage at 20 and 30 Kr (ate 6,7,8).

Similar findings were reported by Conger (1973) in barley. He found that Vit C protected against radiation damage when given as a pre-irradiation treatment, but not as a post-irradiation treatment. The same author justified that the protective effect of ascorbic acid is related to reduced hydration of the barley embryos and that it may occur as a result of the interaction of ascorbic acid with radiation-induced free radicals.

Since, radiation is known to inhibit plant growth, it is natural to suppose that applied growth substances might ameliorate some of the effects of radiation. El-Keredy **et al**. (1975) showed that GA could readily reverse radiation damage to wheat seedlings and Paliwal **et al**. (1975) found that GA increased alpha amylase activity in both irradiated and controlled barley seeds. Hence, in the present investigation, Vit C activated/enhanced the synthesis of GA which was inturn increased the activity of alpha amylase. It was evident from the present investigation that the lose dose radiation (LDR) at 10 Kr improved the performance of mildly and moderately aged seeds of brinjal when exposed to gamma radiation.

In the present investigation, an attempt was made to see the effect of magnetic treatment on differentially

PLATE 5a-b. Pattern of Tetrazolium staining of seed embryos after 0 and 10 Kr gamma radiation in untreated brinjal cv. PKM 1

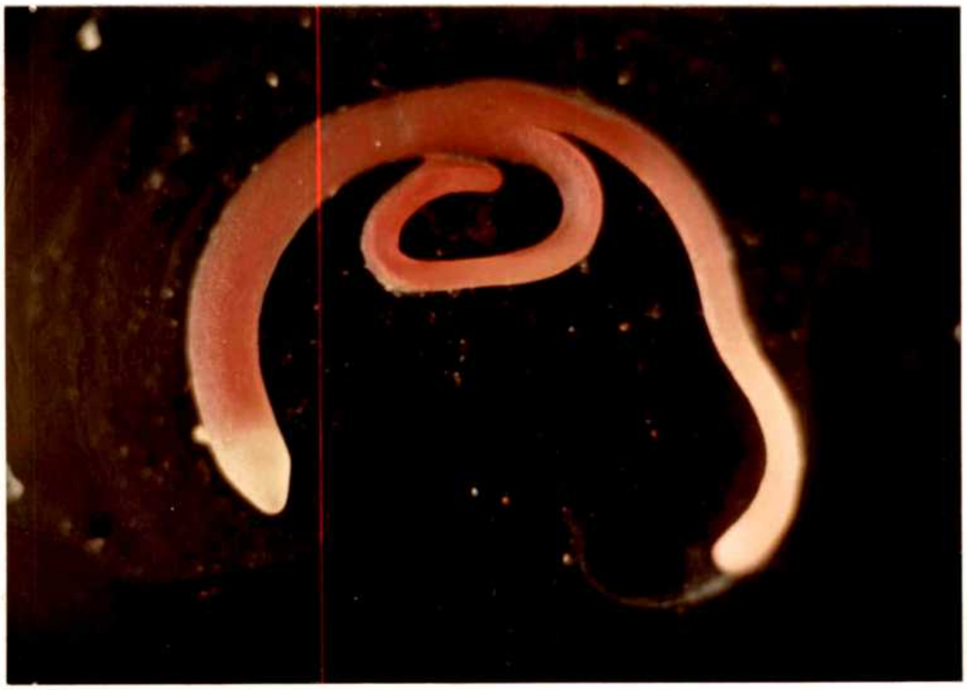


PLATE 5c-d. Pattern of Tetrazolium staining of seed embryos after 20 and 30 Kr gamma radiation in untreated brinjal cv. PKM 1

PLATE 6. Influence of gamma radiation 0, 10, 20 and 30 Kr on germination (%) in untreated brinjal cv. PKM 1

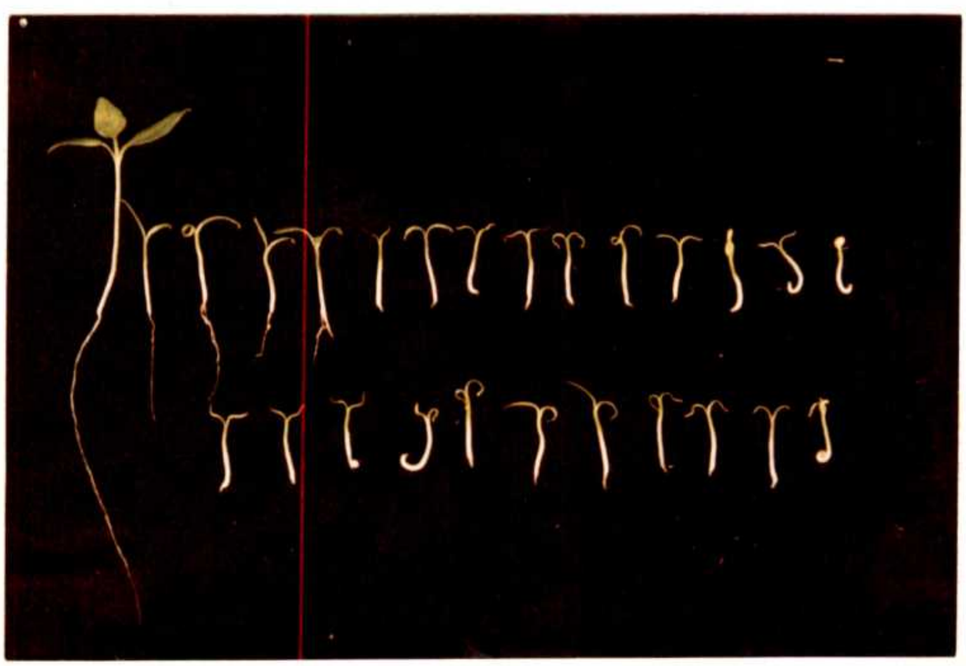


PLATE 7. Production of abnormal seedlings with abrupt root, thick cotyledonary leaves without true leaf in water soaked and irradiated seeds of brinjal cv. PKM 1

aged seeds of brinjal cv. PKM1. Seeds with different levels of ageing were subjected to electro-magnetic field at 400 gauss for a duration of 2, 4 and 8 hours.

The present study revealed more pronounced effects as ageing advanced when seeds were subjected to a magnetic field of 8 hours (M_3).

Prolonged magnetic treatment resulted in increased speed of germination of about 27 per cent in severely aged seeds. Along with the speed of germination, germination per cent also increased to an extent of 7 per cent. The results obtained were in support of Sekhon (1985) in wheat. Recurrent rains after harvesting and before threshing wheat caused different levels of seed deterioration. Prior to sowing in the field, the seeds were exposed to magnetic field. Magnetic treatment showed higher rate of germination and seedling establishment compared to untreated seeds. He also noticed the responses of seeds to the treatments depended on the degree of their deterioration.

The results also revealed that the root and shoot length increased as duration of magnetic treatment increased. However, only severely aged seeds performed better when seeds subjected to magnetic field for prolonged period. The effect on non aged seeds were considerably less when compared to aged seeds.

As regards to seedling dry weight, 8 h exposure to magnetic field showed significant increase in severely aged seeds compared to control. This was in conformity with the results of Lebedeve **et al**. (1975) who observed increassed dry matter production of about 50 per cent in wheat, sunflower and soybean when seeds were germinated for 4-6 days in a paramount magnetic field.

Similarly Kolla et al. (1974) also noticed increased dry weight and decreased intensity of superweak etiolated seedlings when seeds were subjected to a magnetic field of 500 oersted for 15 minutes. He suggested that seed treatment in a magnetic field increased activity of antioxidants in the lipid membrane of cells.

In the present study, prolonged magnetic treatment for 8 hours showed remarkable increase in aged seeds compared to control. Similar trend in increased vigour was also observed by Murphy (1942) when he subjected tomato seeds to magnetic field, improved the vigour and dry matter production.

Seed storage is a serious problem in the tropics. During storage biological, physical and social factors interact and consequently seeds with very variable qualities become available for planting. In the temperate climate the role of biological agent is minimal but in the sub-tropics the interaction of all factors is vigorous. Unfortunately, the science of seed storage is only in infancy stage in this climate (Yadav, 1994).

The longevity of seed is altered primarily by temperature, moisture content and oxygen pressure (Barton, 1961). Of these, seed moisture is the most important factor that decides the shelf life of the seed (Roberts, 1972). Hence, in the present study, the brinjal seeds were pelleted with different tree leaf powders, primed with Vit E and dry dressed with Captan, and tested the efficacy under storage.

Priming with Vit E showed higher viability than pelleting and Captan treatments. Similar beneficial effect on storability was reported by Goreki and Harman (1987) when the pea seeds were infused with 0.1 per cent butyl hydroxy toluene (BHT).

Seeds pelleted with Arappu and Pungam also maintained its superiority in germinability than the untreated control even after eight months of storage. This was in conformity with the results obtained by Umarani **et al.** (1994) in **Casuarina equisetifolia**.

Pre-storage seed treatment with Captan as fungicide was also found to maintain, though not as high as Vit E and pelleting treatments, germination above certification standard compared to untreated control. This was in agreement with the findings of Satyanarayana and Muralimohanreddy (1994) in sorghum, pearlmillet and maize; and Savitri **et al.** (1994) in groundnut.

In the present study, the root and shoot length and vigour index of untreated control seeds decreased with increase in storage period. Similar results were reported by Agrawal (1974) in maize and Subbarao (1984) in brinjal. Seed deterioration is associated with decreased growth of root and shoot (Abdul-Baki and Anderson, 1973).

In the present study, Vit E, Arappu and Pungam protected the seed under storage against biological and environmental adversities and improved substantially over the control.

It can be concluded that pelleting treatments protected the seeds from biological agents of micro as well as macro in nature due to its fungicidal/insecticidal properties and false colour apart from the environmental factors like high temperature and high humidity. The study also revealed that when the pre-sowing pelleting and treated seeds were left unused due to unavoidable reasons, such seeds can safely be carried to next season without loss of germinability and vigour.

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CHAPTER VI

SUMMARY

The salient findings of a series of studies conducted in the Department of Seed Technology on various aspects viz., tracing the pattern of seed deterioration under accelerated ageing, performance of pre-sowing treatments on differentially aged seed progenies under laboratory and field conditions, performance of their resultant seed, performance of treated seeds under different soil and water holding capacities, performance of treated and irradiated seeds, performance of differentially aged seeds on gamma irradiation and magnetic treatment and performance of pre-treated seeds under storage on brinjal cv. PKM 1 are summarized here under.

The seed lots lost their viability within 6,10 and 16 days after accelerated ageing and the seed were dead after 18 days of accelerated ageing under a regime of 40 ± 1°C and 98 ± 2% relative humidity.

Under accelerated ageing, decline in shoot length was faster than root length. Leakage of elctrolytes was high in later part of accelerated ageing than earlier part.

Under field conditions, Notchi, Vit E, and Pungam demonstrated its superiority to promote germination of seeds in all age groups over the controls as well as other treatments.

Pelleting and priming treatments showed an improvement in root and shoot length over the control in all differentially aged seed progenies.

Vit E and Notchi pelleting improved plant height and leaf area irrespective of the level of ageing.

Increased flower number was shown by Acacia and Vit E treatments.

Vit E followed by Acacia improved the fruit length and fruit volume in non aged and differentially aged seed progenies.

Fruit diameter was increased by $CaCl_2$ followed by Acacia and Vit E.

Among the treatments, Acacia and Vit E recorded sizeable increase in fruit yield in aged seed progenies.

Among the treatments, Acacia in non aged seed progenies and Vit E in differentially aged (A_1,$A_2$and A_3) seed progenies registered better increase in seed yield over respective control.

In severely aged seed progenies, Vit E, Acacia and $CaCl_2$ treatment increased the seed number per fruit to an extent of 10 to 22 per cent over the control.

The seed recovery of differentially aged seed progenies was ranged from 4.5 to 3.6 per cent. There was no significant difference in seed recovery in either non aged or differentially aged seed progenies.

An increased earliness was registered by Vit E, Arappu, Acacia and $CaCl_2$ in severely aged seed progenies over the control.

Wider variations in per cent germination was observed between non aged and severely aged seed progenies of resultant seed. Where as, the differences were minimum between mildly and moderately aged seed progenies.

The study on influence of different soil and water holding capacity revealed that the response to seed treatment and pelleting was comparatively more in black soil than in red soil at all water holding capacities. At 100 per cent water holding capacity all the treatments failed to germinate in red soil. However, Vit E, Vit C and Pungam treatments showed 12 to 65 per cent germination in black soil.

The untreated seeds recorded the standard germination percentage only at 40 and 60 per cent water holding capacity. Whereas, Vit C and Vit E treated seeds recorded the standard germination percentage at all water holding capacities except 100 per cent.

At 30, 40 and 60 per cent water holding capacity all treatments recorded higher root and shoot length in red soil than in black soil. Whereas, at 80 per cent water holding capacity, all the treatments recorded higher root and shoot length in black soil than red soil.

Regardless of soil type, 60 per cent water holding capacity and regardless of water holding capacity, red soil showed higher dry matter production in untreated control. Vit C in black soil and Vit E in red soil recorded significantly higher dry seedling weight than the respective control.

Studies on the influence of gamma radiation on pretreated seeds revealed that Vit C improved the germination at 10 Kr compared to water soaking treatment and control.

There was a drastic reduction in root and shoot length of water soaking treatment at all doses (10, 20 and 30 Kr) of gamma radiation. Whereas, Vit C improved the root length compared to control.

Studies on the influence of gamma radiation on differentially aged seeds revealed that 10 Kr increased the germination per cent of mildly (A_1), moderately (A_2) and severely (A_3) aged seeds to an extent of 12, 16 and 14 per cent respectively.

10 Kr increased the root length of mildly (A_1) and moderately (A_2) aged seeds to an extent of 40 and 24 per cent respectively.

Studies on the influence of magnetic treatment on differentially aged seeds revealed that prolonged magnetic treatment of 8 hours increased the germination of mildly, moderately and severely aged seeds.

Magnetic treatment for 8 hours showed increased root and shoot length in severely aged seeds.

Storage studies with pelleted seeds revealed that Vit E treated seeds can be stored for prolonged period followed by Arappu and Pungam. Pelleted seeds showed acceptable vigour and viability even after 8 months of storage.

It can be concluded that presowing seed treatments in some or other form are considered necessary for brinjal seeds to rejunavate the seed quality.

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