REVIEW
OF
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In general, many orthodox vegetable seeds deteriorate rapidly under the hot and humid conditions prevailing in most parts of India. Therefore, attempts were made to standardize easily practicable methods of seed invigoration treatment as well as choice of suitable containers for the maintenance of vigour and viability of seeds during storage. The recent major research reports on these aspects are reviewed in the subsequent paragraphs.

Seed invigoration treatments have been developed to improve both the rate and uniformity of germination in many kinds of crop seed including vegetable seed. Dry seed treatments are ideal for large scale application. Prior to bagging and storage, physiological dry treatments can be combined with dry fungicidal and insecticidal formulations.

(a) Storage Container
The choice of proper seed storage containers depends on the kind and quality of seeds as well as duration and condition of storage. Seed storage in a suitable container maintain the vigour and viability of seeds for larger periods. Many workers have tested the efficacy of several containers in prolonging the storage life of various crop plants.

Singh and Singh (1990) demonstrated the effect of different containers on storability of onion seeds. Here onion seeds with 8% initial moisture content were dried to 4.1%, and stored in various containers, viz., cloth bags (CB), sealed single (SP), double (DP) or triple (TP) layered polyethylene pouches and in sealed glass bottles (GB). Germination percentage declined rapidly after 15 months in seeds stored in CB. Germination of seeds stored in polyethylene pouches decreased 21 months after storage and there was no advantage in use of more than 1 layer of polyethylene. Seeds stored in GB remained viable longer than in other containers and after 24 months, germination in these seeds
were 79% compared to 85% before storage. Seeds stored in CB, SP, DP and TP gave
40%, 71%, 72% and 71% germination, respectively.

Vallador et al. (1990) studied the effects of moisture content, packaging material and
seed treatment on viability and growth of maize (cv. IPB Var 2) seeds. Germination was
41.1-73.7%, 30.7-60.8% and 28.6-69.3% after 3-9 months of storage in flour sacks, tin
cans and plastic bags, respectively. Root and shoot length of germinating seeds were
highest in seeds treated with charcoal compared with cooking oil, naphthalene or saw
dust.

Nautiyal and Joshi (1991) stored groundnut pods in gunny bag, polyethylene lined gunny
bag or in polyethylene lined gunny bag with the desiccant CaCl$_2$ and found significant
differences in seed viability and percentage germination after 8 months of storage. The
high viability and vigour of seeds stored in polyethylene lined gunny bag with CaCl$_2$
was confirmed by several physiological and biochemical parameters. Accumulation of
total soluble sugar and phenolics in seeds during storage was negatively correlated with
seed viability. Similarly, Tripathy et al. (1996) showed that groundnut cv. JL-24 seeds
stored in polyethylene-lined gunny bags containing CaCl$_2$ had the highest field
emergence and produced the highest pod yield. Ramaiah et al. (1999) treated red-gram
hybrid seeds cv. 3C and TTB7 with 2.5 or 5 kg asafoetida, camphor or naphthalene/kg
seed, 5 or 10 kg ash/kg seed or 85 kg red earth/kg seed alone or with malathion and
thiram, which were stored for 1 year in glass bottle or cloth bag under ambient condition.
All treatments were found to maintain seed viability.

Cotton cv. Acala del Cerro seeds were stored in storehouses at three locations in Para,
Brazil, either in multi-chamber paper bags, extruded paper bags, metal cans or plastic
silos. Seeds kept in extruded paper bags or metal cans did not show significant decrease
in germination percentage, while seeds kept in multi-chambered paper bags had a lower
germination percentage from 4th month of storage (Ohashi et al., 1991). Safflower seeds
packed in polyethylene bags maintained high viability with time due to minimized
moisture fluctuation and consequently produced more vigorous seedlings compared to
those stored in jute or cloth bags that had little protection against moisture (Chaijan and Tarar, 1992). Similarly, Majhi and Bandopadhyay (1993) found that germination percentage and root and shoot length of groundnut were high when seeds were stored in glass bottles or polyethylene packets but were comparatively low when stored in paper packets or cloth bags.

Kenghe and Kanawade (1996) noticed that chick pea cv. P.G. 5 seeds stored for 7 months in Kangi bins lined with plastic film and in the jute bags had the highest (79%) and the lowest (71.2%) germination percentage, respectively. Verma et al. (1991) recorded after 11 months of storage, the highest percentage of germination and greatest seedling vigour in cauliflower seeds stored in laminated bags in comparison with bamboo paper bags or unsealed polyethylene bags under ambient condition. Shelar et al. (1992) tested the efficacy of cloth bags, paper bags or aluminium foil packets for storage of onion seeds dried to a moisture content of 5%; they found that the germination percentage was maintained above 70% after 360 days of storage in 2 moisture impermeable containers i.e., plastic bags and aluminium foil packets, whereas more than 70% germination was maintained for 300 days in other containers (moisture permeable). After 440 days of storage, germination percentage had fallen to less than 40% in the 3 permeable containers, but was still more than 50% in the 2 impermeable ones.

Seeds of Lupinus angustifolius cv. IAPAR 24 Villa Velha grown in Panta Grossa, Brazil in 1989-90 were stored in jute, multi-foil or polyethylene bags and stored for up to 24 months. For storage of seeds having 11-13% moisture content up to 15 months, all types of bags were equally suitable, but polyethylene bags were more efficient in maintaining moisture content and physiological quality for up to 18 months (Crochemore, 1993). Currah and Msika (1993) found that onion seeds cv. Red Creole retained 53% germination capacity after 3 years in paper packets, though they germinated much more slowly than seeds stored in airtight jars. Umarani and Selvaraj (1996) observed that viability and seedling vigour remained higher for seeds of soybean (cv. Co. 1) stored for 8 months in polyethylene bags compared with cloth bags and there
was decline in protein and oil content over this period, but the fall was less with polyethylene bag storage.

In an experiment mature seeds of *Hibiscus subdariffa* (cv. HS 4288) were sun-dried before storage for 4 years in (1) gunny bags under ambient conditions, (2) earthen pots, (3) capped glass jars or (4) in temperature and humidity controlled chambers. Here viability and germination percentage of these seeds decreased during the first year of storage by 8% and 22%, respectively in earthen pots and by 10% and 33%, respectively in gunny bags. Seeds stored in glass jars or in controlled atmosphere chambers could be stored for 4 years without marked deterioration of viability and germination percentage (Ghosh and Das, 1997). Sinha *et al.* (1997) pointed out that shelled seeds of groundnut cv. Big Japan and M-13 stored in polyethylene bags maintained high viability for 14 and 10 months, respectively. The corresponding seed germination percentages were 82 and 89. Polyethylene bag was found much better than the cloth bag for maintaining seed viability. Similarly, Sivasubramaniam *et al.* (1997) observed that germination percentage of *Moringa* seeds was higher when stored in polyethylene bags than when stored in cloth bags. Duan Naixiong and Jiang Huifang (1997) stored dried seeds and pods of 3 groundnut (*Arachis hypogea*) genotypes with different seed moisture content in sealed containers at room temperature for 7-12 years, and found that under the climatic conditions of Wuhan (China), dried seeds of groundnut can be stored for 11 years or more without significant deterioration. Ismail (1997) stored aburgine seeds (6.6% m.c.) at room temperature (14.9-30.78°C) or at 5°C in either cloth bags, aluminium foil bags (0.05 mm) or tin cans for 24 months. The results reported were as follows: i) seeds stored at 5°C retained their viability better than those stored at room temperature; ii) tin cans were best packing type to retain viability for seeds stored at 5°C; iii) the slowest germination rate was observed for seeds packed in cloth bags and stored at room temperature and iv) seedling length and total protein content decreased with increased storage period. Seeds could be safely stored in tin cans or aluminium foil bags for 24 months at 5°C (germination 78.83 and 71.75%, respectively). Krishnappa *et al.* (1998) studied the effects of packaging material on seed quality of groundnut. Groundnut cv. JL-24 and TMV-2 seeds were dried to about 7% moisture content and
stored for up to 16 months in ambient condition in different containers e.g., gunny bags, tar coated bags, polyethylene lined gunny bags, high density polyvinyl bags and kraft paper bags. Among containers, the polyvinyl bags gave the greatest percentage of germination and seed vigour after 16 months; all containers maintained the minimum certification standard of 70% germination for 12 months and polyvinyl bags maintained this standard for 14 months. Meena et al. (1999) reported the effect of storage containers on seed longevity in cotton (Gossypium hirsutum). In this experiment delinted seeds of 15 cotton cultivars were stored in cloth or polyethylene bags for up to 24 months. Germination percentage and vigour index decreased more in cloth bag than in polyethylene bag, and the rates of decrease were greater. Germination percentage and vigour index differed significantly among cultivars. The germination percentages of the cultivars were different between the 2 types of bag.

The maintenance of high viability in the carry-over seeds is of vital importance to the seed producers. Proper storage conditions are rarely available in India, so the use of fungicides is important. Chilli seeds (cv. Pusa Jwala), produced in the Kharif season of 1988 were treated in April, 1989 with 0.25% Thiride (thiram) and 0.2% of either Deltan (captan), Bavistin (carbendazim) or Dithane M-45 (mankozeb). Half of the seeds was stored in a tin container and the remainder in a cloth bag. The seed viability was determined at 10 days intervals between 5 and 20 months after harvest. Seeds deteriorated less rapidly in the tin container than in the cloth bag, and fungicide treatments were largely ineffective, except for the thiram treatment which improved seed viability in tins. Between 5 and 10 MAH, seeds lost 6-15% viability in tins and 26-32% in the cloth bags (Gupta et al., 1992). In contrast, when seeds of groundnut (cv. TMV2) dried to 4.6% moisture content were treated separately with fungicides, insecticides and fungicide-insecticide combination and stored in cloth bags and polyethylene bags of 600 gauge under ambient condition for a period of 18 months, the seed treatment with thiram (3 g/kg) controlled seed borne fungi effectively and also protected seeds of groundnut from attack by Corcyra cephalonica for a considerable period and maintained seed viability and vigour for up to 18 months in polyethylene bags (Savitri et al., 1998).
(b) Seed Invigoration

Seed invigoration, in general, improves the vigour and viability in medium and low vigour seed lots. The invigoration treatments can be broadly classified in to two groups: wet and dry treatments (Basu, 1994).

(i) Wet treatment

Wet treatments include soaking-drying, dipping-drying, moisture equilibrium, simple soaking in water or in chemicals, etc. Basu and Mandal (1997) reviewed the efficacy of different wet treatments in maintaining the viability of vegetable and flower seeds.

Mathew and Alexander (1991) found that when rice cv. IR-8 seeds were soaked in water, 0.5% or 1.0% NaCl, CaCl$_2$, Na$_2$SO$_4$ or MgSO$_4$ or in 0.1% or 0.2% succinic acid or acetic acid, most of the treatments brought about germination of greater than 80% after 3 months of storage and greater than 40% after 6 months of storage. Germination after 6 months was highest (76%) in seeds soaked in 0.5% NaCl.

In another study, Paul et al. (1998) noticed best germination percentage when malathion + captan (each 2 g/kg seed) treated wheat seeds (cv. Sonalika) were dipped in Na$_2$HPO$_4$ (10$^{-4}$ M) for 5 minutes before storage.

**Hydration–dehydration treatment**

Hydration-dehydration treatment as a means for maintaining viability of seeds during storage has been tried by many workers. Mid-storage hydration-dehydration treatments were shown very effective in slowing down seed deterioration in several orthodox agricultural and horticultural crop seeds (Saha and Basu, 1984). They demonstrated that moisture equilibration followed by soaking and drying or moist sand conditioning followed by soaking and drying treatment would reduce the loss of vigour and viability of stored medium vigour soybean seeds. Sur and coworkers (1989) treated bamboo (*Dendrocalamus strictus*) seeds in various ways before storage in order to prevent its usual loss of vigour and viability. Here seeds collected 20 days previously and stored in the laboratory were either soaked for 6 h in water followed by drying or exposed to
moisture equilibration with a water saturated atmosphere for 48 h followed by drying. Both treatments effectively reduced the loss of viability of seeds stored under natural warm humid condition for up to 6 months in contrast to untreated seeds which completely failed to germinate after 4 months, and after 8 months of storage the germinability of hydrated-dehydrated seeds started to decrease rapidly. It is also observed that the loss of germinability was less rapid in hydration-dehydration treatment than in moisture equilibrium treatment. Ramamoorthy et al. (1989) showed the effect of soaking-drying treatment for maintaining viability and vigour in lima bean (Phaseolus lunatus) seeds stored for 4 months under ambient condition. The seeds were soaked in water for 15 or 30 min, dried to original moisture content and subjected to accelerated ageing at 98% RH and 40 ± 1°C for 15 days. The treated seeds gave 71-73% germination. However, longer soaking (1 or 2 h) resulted in 68 and 50% germination, respectively. Membrane integrity and dehydrogenase activity were not adversely affected in treated seeds which had been soaked for a shorter duration (15 and 30 min). Hofinan and Steiner (1994) reported that the effect of hydration-dehydration seed pretreatment on longevity was largely dependent on the quality of the seed at the time of pretreatment. Pre-treating wheat seeds of high quality increased the rate of viability loss during subsequent storage whereas pre-treating seeds of relatively low quality decreased the rate of seed deterioration during subsequent storage. Yogalakshmi et al. (1996) observed that mid-storage treatment prolonged the storage life of seeds. When 8 months old seeds of CORH1 hybrid rice and its parental lines (IR 62829A, IR62829B, IR1019866-2R) were subjected to hydration-dehydration mid-storage treatment with a number of different chemicals like disodium phosphate, sodium thiosulphate, sodium chloride, water, aminobenzoic acid, hydroxybenzoic acid and neem kernel extract, mid-storage treatments extended the storage life of rice seed, disodium phosphate being found as the most effective chemical. Similarly, when eight-month-old maize seeds were subjected to hydration-dehydration treatment using 1000 ppm KH$_2$PO$_4$ or 1% KCl, germination was 87.6% with KH$_2$PO$_4$, 84.2% with KCl and 81.9% in control (Bharathi et al., 1997). They noticed further that storage in polyethylene bags maintained vigour better, and gave higher germination than storage in gunny bags.
In an experiment, pea (cv. Arkel and Bonneville) seeds were given the following treatments: soaking for 1 h followed by drying at 35°C (S-D); moisture equilibration at 100% RH and 28°C for 48 h followed by drying (ME-D), and moisture equilibration followed by soaking followed by drying (ME-S-D); treatment with calcium oxychloride or iodine, methanol, ethanol or isopropanol applied with a calcium carbonate career. Seeds were then stored for 9 months at 64.7% RH and 26.7°C. Three controls were used: aged, career treated and non-aged seeds. Seed germination was highest in the non-aged control (90% in Arkel and 99% in Bonneville) followed by treatment with calcium oxychloride or methanol (83% in Arkel and 97% in Bonneville). The vigour index was highest in the non-aged control followed by treatment with calcium oxychloride in both cultivars. S-D, ME-D and ME-S-D treatments gave seed germination of 46%, 61% and 71%, respectively in Arkel and 35%, 84% and 81%, respectively in Bonneville (Bhattacharyya and Basu, 1990). Nath et al. (1991) pointed out that 2 h pre-storage hydration-dehydration treatment of wheat cv. Karamu seeds followed by drying helped in maintenance of germinability in storage, but only had marginal effects when applied after ageing. Longer hydration treatment (24 h at 15°C or 20 h at 20°C) applied after storage was effective at restoring germination rates of seeds that remained viable. If applied before storage, however, these two treatments severely increased the seeds’ susceptibility to deterioration. Madanagopal and Dharmalingam (1993) showed that among various durations of hydration/ dehydration (0.5-8 h soaking in distilled water followed by drying to original mc), 2 h soaking gave the highest germination (69%) of S. indicum cv. TMV3 seeds. Moisture equilibration followed by drying was less effective, giving a maximum germination of 58% after 24 h moisture equilibration in a saturated atmosphere. Iodine permeation-drying (placing in an iodine-saturated atmosphere for 10-17 h and then drying) gave 37% germination after 12 h permeation. Mitsuko et al. (2005) reported in details the effect of various hydration and dehydration cycles on seed germination of Aster kantoensis (Compositae) which were experimentally exposed to different cycles of hydration and dehydration: 3H1D (cycles of 3-d hydration and 1-d dehydration periods), 2H3D, 2H1D, 1H3D, 1H2D, and 1H1D. Under continuous hydration (control), all viable seeds germinated within 9 days. However, all viable seeds exposed to the 3H1D, 2H3D, and 2H1D cycles germinated within 36, 50 and 36 days of
the start of the experiment, respectively. Not all viable seeds exposed to the 1H3D, 1H2D and 1H1D cycles germinated during the experimental period. Compared with the control, the number of days required for 50% germination increased in seeds exposed to the hydration-dehydration treatments except for those seeds exposed to the 3H1D and 2H1D cycles. In addition, seeds treated with a 1-d hydration period required a larger number of cumulative hydration days for 50% germination than those seeds exposed to one of the other three treatments or the control.

(c) Dry treatment
That certain dry seed treatments help in maintaining viability and vigour of various crop seeds has been demonstrated by several workers in the recent past (Basu, 1994). The dry seed treatments include fungicides, pesticides, other chemicals like growth regulators, halogens and some natural crude plant materials.

Usha et al. (1990) showed that seeds of cowpea (Vigna unguiculata) and horsegram (Dolichos biflorus) treated with malathion and stored in polyethylene bags retained seed viability over a period of 8 months. The efficacy of several fungicidal seed treatment was evaluated in laboratory test on cotton seeds of (Gossypium arboretum cv. AKA-8401 and G. hirsutum cv. L-147). Thiram plus carboxin (as Vitavax) 2:1 at 0.3% was the most effective treatment in controlling seed borne fungal pathogens, improving seed germination and increasing the root-shoot length in both cotton species (Kale et al., 1992).

Treatment with 5 different chemicals (thiram, captan, captafol, atonik and cytozyme) alone and in combination failed to increase the self-life of onion seeds beyond 1 year. A sudden fall in germination percentage with all treatments after June was attributed to increase in temperature and RH (Gupta et al., 1989). In an another study Solanke et al. (1997) found that among the treatments with fungicide thiram (2.5 g/kg) and ABC dust (5 g/kg) of sorghum (cv. PVK-400) seed, germination was significantly superior in thiram treated seed (65%) to ABC dust (59%) and untreated control (57%) after 36 months of storage. Shah and Mariappan (1990) tested sorghum cv. Co19 seeds for
viability after 3-6 and 9 months of storage following treatment with 0.2% thiram, Vitavax [carboxin] and captan, 0.4% wettable S and 0.2 and 0.4% Panotine (guazatine acetates) and Panoram (fenfuran). Seed viability after 3 months of storage was 81.66-93%. After 9 months of storage, thiram, Vitavax and 0.4% Panotine and Panoram maintained 66-73.66% seed viability as against 45% in untreated seeds.

Laxminarayan and coworkers (1999) demonstrated the beneficial effect of insecticidal dust on germination of greengram. When fenvalerate 0.4D, methyl parathion 2D, endosulfan 4D, quinaphos 1.5D (each at 2.3 and 4 g/kg seed) or recommended malathion 5D at 2.5 g/kg seed were mixed with greengram (cv. Asha) seed to evaluate their effect on seed quality up to 180 days of storage, all the doses of fenvalerate 0.4D, endosulfan 4D and malathion 5D improved germination, vigour index, whereas methyl parathion 2D and quinalphos 1.5D inhibited the germination and vigour index compared with untreated control. In another experiment, Vasundhara and Gowda (1999) also studied the effect of fungicidal seed treatment on seed quality of groundnut in storage. When the seeds of groundnut cv. TMV2. JL24 and ICGS11 were treated with Captan, Bavistin [carbendazim], Emisan [2-methoxy-ethylmercuric chloride] or thiram and stored in cloth bags at room temperature for 12 months, germination percentage after storage was highest when treated with Captan and lowest in untreated control.

Dry treatments of high-vigour seeds with halogenated compounds (chlorine and iodine), non-toxic chemicals, pharmaceutical formulations and crude plant materials have been found to be effective in slowing down seed deterioration of several crop seeds (Mandal and Basu, 1986; Mandal et al., 2000; De et al., 2003, 2004; Mishra et al., 2005).

Pal et al. (2001) reported that invigoration treatment of high vigour wheat by dry dressing with Aspro (active ingredient 56.5% orthoaecetylsalicylic acid or aspirin) at 0.1 g/kg seed and bleaching powder (active ingredient calcium hypochlorite 30%) at 3 g/kg of seed effectively reduced physiological deterioration in storage. The same dry seed invigoration treatment of medium vigour wheat seed showed marginal improvement with bleaching powder followed by aspro but these dry treatments were not effective in
low vigour wheat seed. Wet seed invigoration treatment employing water soaking-drying was not effective in high vigour but showed significant improvement in medium and low vigour wheat seed for storability as well as field performance.

Treatment of harvest fresh high vigour wheat seed (*Triticum aestivum* L. cv. Sonalika) by dry dressing with crude plant material (dried and finely powdered ripe red chilli fruit and turmeric rhizome) @1-2 g/kg seed and pharmaceutical formulation viz. aspirin-containing Aspro and ascorbic acid-containing Celin (100 mg/kg seed) and commercial calcium hypochlorite, active ingredient of common bleaching powder (2 g/kg seed) greatly reduced the loss of vigour and viability under accelerated ageing at 100% relative humidity and 40°C and natural ageing under ambient condition (Mandal *et al.*, 1999). Earlier De *et al.* (1998) showed that pharmaceutical formulation Aspro (a commonly used aspirin containing formulation), vitamin C containing Celin and ibucon applied at the rate of 100 mg/kg seed showed significant improvement in germinability over untreated control under accelerated as well as natural ageing condition. They also observed that common bleaching powder used at the rate of 2 g/kg seed and commercial camphor at the rate of 100 mg/kg seed also brought about beneficial effects on germinability of stored blackgram seed.

According to Shekhargouda (1997), treatment of 8 and 20-month old safflower cv. Annigeri-1 seed with 1% calcium chloride increased germination to 81.5% and 69.7%, respectively. Treatment with 1% calcium nitrate, cattle slurry, 50 ppm ascorbic acid, 1% potassium chloride or 1% potassium sulfate also showed better germination of over 65% in 20-months old seeds.

Umarani *et al.* (1997) treated seeds of *Casuarina equisetifolia* with leaf powder of arappa *Albizia amara* (10g/100g seed), neem (10g/100g seed) and notchi (*Vitex negundo*) (10g/100g), neem oil (1ml/100g seed), captan or thiram alone (2g), carbaryl (200 mg) or captan or thiram + carbaryl (1g + 100 mg) and stored in polythene and paper bags for 7 months. Although seed viability and vigour decreased with the increasing period of storage, arappu treatment, followed by captan + carbaryl treatment
gave better result than other treatments including control. The germination percentage of untreated seeds dropped from initial 70% to 22% in the control after 7 months of storage, while in the arappu leaf powder and captan + carbaryl treatments, the germination was 88% and 31%, respectively.

Sengupta et al. (2005) investigated the efficacy of certain dry seed invigoration treatments (pre-storage) on freshly harvested (high-vigour) onion seed (Allium cepa L. cv. Sukhasagar) with finely powdered pharmaceutical formulations (aspro, active ingredient ortho acetyl salicylic acid at 100 mg/kg of seed; ibucon, active ingredient ibuprofen 28.75% and paracetamol at 100 mg/kg of seed; celin, active ingredient ascorbic acid, at 500 mg/kg of seed), chemical (common bleaching powder, active ingredient calcium hypochlorite, at 2 g/kg of seed) and crude plant materials (finely powdered dry red chilli fruit and Trigonella seed powder at 1g/kg of seed; Catharanthus leaf powder at 2 g/kg of seed). These treatments significantly slowed down seed deterioration in comparison to untreated control under subsequent storage conditions (after accelerated and natural ageing). In general, pre-storage wet treatments did not show any beneficial effect on storability. Only marginal improvement of germinability was noted by dipping-drying treatment over untreated control. The crop raised from the treated and untreated seeds showed that all the physiological treatments, especially, common bleaching powder, red chilli powder and aspro significantly improved field performance and productivity of the crop over untreated control. The membrane functions as determined by leakage of electrolytes and sugar were significantly lower in the dry treated seeds than in the control. The dehydrogenase enzyme activity was also significantly higher in the treated seeds than in the untreated control. The results indicate that pre-storage dry seed invigoration treatments of high-vigour onion with common bleaching powder, red chilli powder and aspro may be suggested for the improvement of storability and field performance.

In an earlier report, Rudrapal and Basu (2004) showed that the deterioration of high vigour (HV) French bean (Phaseolus vulgaris L. cv. Pusa Parvati) seed during storage could be significantly slowed down by pre-treatment of the seed with powdered plant
materials such as dried leaves of bitter gourd (*Momodica charantia* L.) and amrul (*Oxalis comicularata* L.) at the rate of 2 and 2.5 g per kg of seed, respectively, and pharmaceutical formulations namely, ‘aspro’, a commonly used aspirin-containing formulation (56.5% aspirin with 43.5% paracetamol) and ‘celin’, ascorbic acid (vitamin C)-containing formulation at the rate of 0.2 and 0.5 g per kg of seed, respectively as well as by the common bleaching powder (active ingredient chlorine released from calcium hypochlorite) at the rate of 3 g powder per kg of seed. The vigour status of seed interacted with the different treatments to give differential response in respect of post-storage germinability and seedling vigour. The high vigour (HV) seed lot proved more responsive to the dry treatment than the medium vigour (MV) seeds. On the other hand, in low vigour (LV) seeds, the dry treatments did not show any promotion of germinability and seedling vigour. The wet treatment, moisture equilibration-drying (humidification-drying treatment), was very effective in the medium vigour seed lot, but not in high and low vigour seeds. The dry treatments given to high vigour or the wet treatments to medium vigour seeds resulted in better post-ageing performance which would indicate that the beneficial treatments reduced degradative reactions responsible for the loss of seed vigour and viability.

*Mandal et al. (2008)* reported that pre-storage dry treated seeds of sesamum (*Sesamum indicum*) showed better results in maintaining membrane integrity and enzyme activity with reduced lipid peroxide formation and volatile aldehyde production under subsequent storage condition.