Wheat Triticum Aestivum L and Bengal Gram Cicer Arietinum L Seed Invigoration Treatments for Improved Storability and Field Performance

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Abstract

Since the beginning of the agricultural civilisation, keeping seeds alive has been an important issue for humans. The key to productive farming is high-quality seed. Every planted seed in today's farms must germinate quickly and grow into a healthy seedling to guarantee a high harvest. Ancient civilisations probably did not spring up by chance in places with favourable climates for seed survival over extended periods of time. Due to the high degree of reliance on external variables, farmers must always be on the lookout for potential output shortfalls. In addition, as the world's population grows, it's critical that productivity expand at the same pace. Maintaining a buffer seed supply is essential in case of poor field emergence or loss of standing crop due to unexpected rain, flood, or drought, but suitable sowing materials are hard to come by under such circumstances.In this research, we investigate the effects of seed invigoration on the storage life and yield of wheat (Triticum aestivum L.) and bengal gramme (Cicer arietinum L.).

Keywords: *Wheat Triticum Aestivum, Al Gram, Invigoration, Agriculture, Seed.*

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1. Introduction

Over time, farmers have learned the value of high-yielding cultivar seeds, but the significance of a seed's quality within a certain cultivar has only just begun to register. A decent crop stand will be enough to satisfy the farmers. The speed of germination, the consistency of the seedling's appearance, and its resilience in the face of adverse soil and environmental circumstances are still necessary selling points for him to become seed quality aware. Even if farmers try to make up for poor seed quality with better management and cultivation practises, the results may be disappointing. [1-2]

This is why seed is so vital to agriculture in developed nations. From a physiological perspective, there is some scepticism about the quality of the seed used in Indian agriculture. We may probably assume that the bulk of the seed we use to sow field and horticultural crops is of medium to low vigour grade. Only around fifteen percent of our fields are planted with high-quality seeds, while the rest are seeded with seeds grown by local farmers, the vast majority of which lack any kind of quality assurance. [3-4]

Using high-quality seeds has been demonstrated in surveys to significantly boost harvests . Our low seed quality may be attributed to a number of things. While progress has been achieved in the area of scientific seed production, it is still far short of the goal. Quality assurance and seed processing are still in their infancy. Farmers have not given the urgent issue of protecting seeds while they are stored their full attention. However, these factors are crucial for a high-quality planting seed. [5-6]

High humidity and high temperatures in many parts of the nation make seed storage a severe issue. Some sections of the nation are more suited for seed storage than others, have advised safe moisture levels for storing seeds of different crops. It seems that many parts of the nation are not ideal for long-term seed storage in the open air. This means that the seed needs of such regions should be satisfied by shipment from locations more suited for storage. [7-8]

The need for seed in far-flung locations cannot be met with such an idea. Timely distribution of the seed would require the construction of temporary storage facilities in regions deemed inappropriate for lengthy periods of storage, but even then, less-than-ideal storage conditions might reduce seed quality during the brief period of storage.[9-10]

2. Material And Methods

Wheat (Triticum aestivum L., cv. Sonalika) and Bengal gramme seeds were used in the studies. In addition, seeds from the plant known as jure were collected for use in the experiment. Wheat seeds came from Singur Agriculture Farm in Lucknow; gramme seeds came from the State Seed Corporation Ltd. on behalf of the Government of Lucknow; and jute seeds came from the Central Research Institute for Jute and Allied Fibres.

Sun-dried to a moisture level of around 10% for wheat and 9.5 % for gramme, the seeds were then kept in rubber stoppo'äl2.5 litre capacity glass bottles and used intermittently in different experiments.

Research of the decline in vitality and viability of stored wheat and Bengal gramme seed under different environmental storage conditions

Sun-dried wheat seed (variety Sonalika) and Bengal gramme (variety Deshi BG 240) both had moisture contents of about 9.8%. The seeds were then placed in gunny bags and rubber-capped glass bottles before being housed in a Calcutta laboratory at room temperature and relative humidity. Calcutta has an average annual temperature of 27 + 4°C and an average yearly humidity of 66.5 + 2%. Seed viability and strength assessments were performed on a monthly basis. Root and shoot lengths of seedlings grown on the slanted glass plates were used to determine the robustness of the seeds.

Reinvigoration Treatment's Impact on Stockpiled Invlgorate's Vigour and Viability

For this study, we employed Sonalika wheat and Deshi BG 240 gramme, both of which had medium vigour. High vigour (HV) seeds were developed from the original stock material, which had a lower amount of vigour to begin with. Different moist and dry treatments re-energised the seeds that had been stimulated to become active in this way.

Five-month-old seed (medium-vigor) was treated with soaking-drying (S-D) treatments in order to revitalise the original seed stock material. Gramme was solely subjected to moisture equilibration-drying (ME-D) treatments according to the aforementioned method. Invigorated seeds were subjected to a second round of wet treatments after 7 days of moisture stabilisation. These included soaking for 2 hours, then drying (S-D), or moisture equilibration for 24 hours, then drying (ME-D), or dry dressing treatments with bleaching powder (3g/kg of seed), calcium carbonate (3g/kg of seed), iodinated calcium carbonate (30 mg of iodine was thoroughly mixed with 3g of calcium carbonate), m The identical method described above for applying a wet dressing was used for applying a dry dressing in the glass bottles with rubber stoppers. In the same way that the treated seeds were dried, the control (untreated) seeds were also preserved. Single soaking and drying, as well as moisture equilibration and drying, were used as controls in this experiment.

The Impact of Seed Treatment on Field Yield and Quality

(a) Water soaking-drying in 3 days and (b) ascorbic acid soaking-drying in 3 days (50 ppm) were the wet treatment regimens used for wheat midstorage. Sodium phosphate, l 0 M (dibasic) soaking-drying Dripping wet and then air-drying Water vapour equilibrium dehumidification (f) dry-dressing and conditioning by moist-sand drying. Calcium carbonate (g) and iodine-impregnated calcium carbonate (h) Bleach (calcium hypochlorite) powder (i), methanol-impregnated calcium carbonate (j), and isopropanol-impregnated calcium carbonate (k).

There were three types of wet treatments used on Bengal gramme during the middle of storage: (a) water soaking-drying, (b) water dipping-drying, and (c) moisture equilibration-drying. (d) treatments that use wet sand for conditioning and drying, as well as dry dressings vJr. Calcium carbonate (d), iodinated calcium carbonate (f), bleaching powder (g), ethanol (h), methanol (i), and isopropyl (j) are all examples of impregnated calcium carbonate.

Wheat seeds were treated with either (a) water soaking or (b) ascorbic acid soaking (50 ppm) before being planted. (c) Soaking in 10"M sodium bicarbonate Soaking in dibasic sodium phosphate (104 M) (optional) (e) soaking in water, (I) balancing the moisture levels, (g) conditioning with wet sand, and (h) dressing with dry substances. (i) bleaching powder (calcium hypochlorite is the active component) and (h) calcium carbonate Methanol- and isopropanol-impregnated calcium carbonate are listed as (j) and (k), respectively. Similar treatment regimens to those of the mid-storage treatment were used for the Bengal gramme presowing experiment.

To achieve this, treatments were applied to seed that had been aged for 8.5 months (before to planting in the field) and kept in a rubber-stoppered glass container with a 2.5 litre capacity at room temperature and relative humidity (average: 73.1 + 2.8%; average: 28.8 + 1'C). Seeds were soaked for 4 hours in water or diluted chemical solutions for soaking treatments, and then gently air-dried before being planted in the field. The same method as the mid-storage treatment was used for the other hydration (dipping, moisture equilibration, and wet sand conditioning).

Research in the Field

Wheat and gramme seed yields were tested in the field against an untreated control to determine the effectiveness of physico-chemical and dry treatments. Calcutta University's Experimental Farm at Baruipur, 24 Parganas, was the site of the experiments. Three consecutive years of Rabi (winter) wheat and gramme field experiments were conducted utilising a totally randomised block design with four replications of each treatment.

Statistical Analysis

Analysis of variance was used to statistically examine the influence of physico-chemical treatments and dry treat nt on vigour and viability, yield, and other growth characteristics using data from laboratory germination tests and field trials. The data on germination rates were converted to angles (arc-sin) before analysis; the L.S.D. values for viability, when they have been provided, are likewise in angles; and the L.S.D. values for viability supplied are for comparing germination rates in angles alone.

3. Results

WHEAT TRITICUM AESTIVUM L

Identification of the environmental factors influencing the fall in izi vigour and viability of significant wheat (cv. Sonalika)

Sonalika was used as the cultivar in this research. One kilogramme of wheat seeds were individually housed in a gunny sack in a sealed glass bottle to analyse the pattern of seed degradation under ambient conditions. Monthly germination tests were performed to track the reduction in vitality and strength.

The germination rate, as well as the average root and branch lengths of seedlings grown from seeds kept between March and December. The germination rate dropped to half and the seedlings lost vitality after only 6-8 months after harvest. Seeds in unsealed gunny bags lost vigour when the relative humidity began to climb with the beginning of premonsoon and monsoon rains in May and June. Researchers discovered that by the time seeds were planted in the ground in November and December, the germination rate had dropped to zero. Seeds kept in a sealed glass container had a higher germination rate than those kept in a gunny sack.

Seeds housed in airtight glass containers had a much lower germination rate and weaker seedlings when it came time to sow. Under normal environmental circumstances, seed decay was most rapid in July, August, and September. Therefore, precautions against seed degradation during storage should be performed before the onset of the monsoon.

Germination potential of invigorated wheat seed kept under various conditions of reinvigoration

For wheat seed (high medium vigour), wet treatment (soaking-drying or moisture equilibration-drying) was used to revitalise the seed. Wet (S-D or ME-D) or dry treatments with bleaching powder (active component, calcium hypochlorite), iodine, and alcohols were used to revitalise the wheat seed once again.

Tables demonstrate that reinvigoration using dry-treatments (bleaching powder, iodine, and alcohols) is more successful at boosting germinability than using wet-treatments (S-D or ME-D). Significantly better germinability was seen after a single dosage of soaking-drying or moisture equilibration-drying compared to the untreated conti ol. Tables show that the gaseous emanations of the aforementioned two treatments promoted greater jute seedling development (bioassay material). Once revitalised seed that was subjected to a moist treatment (S-D or ME-D) to reinvigorate it had a negative impact on its potential to germinate. However, compared to a single soaking-dq ing or moisture equilibration-drying therapy, reinvigoration by dry treatments (S-D or ME-D followed by a second dose of dry dressing treatment with bleachig powder, iodine, and alcohols) improved ex germinability. revitalised dry treatment gaseous emanations also promoted more jute seedling development than did revitalised wet treatment. Invigorated seed (S-D or ME-D) treated with a dry dressing of calcium hypochlorite (common bleaching powder) showed the greatest improvement in germinability and the highest growth of jute (bioassay material) compared to other treatments.

However, Table shows that soaking-drying and moisture equilibration-drying were shown to be detrimental, leading to a significant decrease in growth of the bioassay material. Jute grew the fastest in areas that were shielded from the gaseous emissions of stock material, known as "blank." All of this fits nicely with what we know about the accelerated and natural ageing of thèse revitalised seeds.

A single dosage of soaking-drying therapy significantly enhanced germinability after 5 months of natural ageing compared to the untreated control. Table shows that the germination rates of invigorated (single soaking-drying) and reinvigorated (double soaking-drying and dry dressing) seed were only slightly different. For example, soaking-drying (invigorated) followed by dry dressing treatment with calcium hypochlorite (common bleaching powder) resulted in significantly higher values'both in terms of germinability and growth of bioassay material (jute).

Table 1: Effect of 'wet' and 'dry' seed treatments on the germinability of invigorated (S-D) wheat seed after accelerated ageing at 98% R.H and 40°C for 5 d•7• and the effect of gaseous emanations of germinating wheat seeds (stock material) on germination and growth of the bioassay material (jute)

Treatments	Germinability of Wheat					Germinabillty of Jute			
	Germinatlon		Mean shoot length (mm)	Me$n root length (mm)	Mcan seedling length (mm)	Germination (%)	Mean shoot length (mm)	Mean root length (Mm)	Mean seedling length (mm}
	(%)	Arc-sin value							
Control (untreated)	44	41.55	19	100	119 (61)	87	6	8	14 (41)
S-D	93	74.66	28	132	160 (82)	9S	7	12	t9 (56)
S-D + ME-D	64	53.13	2G	14	147 (76)	88	6	10	16 (47)
S-D + S-D	47	43.28	24	103	127 (65)	81	6	9	15 (44)
S-D + BLP	95	77.08	30	142	172 (89)	96	8	13	21 (62)
S-D + CaCO	87	68.87	28	129	157 (81)	93	7	12	19 (56)
S-D + lodinc	87	68.87	28	l 2G	154 (79)	89	7	11	1 8 (53)
S-D + Methanol	90	71.56	29	t32	1 61 (83)	92	7	12	19 (56)
S-D + lsopropanol	93	74.66	29	139	168 (87)	95	8	12	20 (59)

Control (non-aged)	98	81.87	32	1 ô2	194 (100)	98	9	16	25 (73)
Dlank						100	1 1	23	34 (100)
L.S.D at 0.0S5 p	-	15.0	5	11	8.1	-			1.9
L.S.D at 0.01 p		20.0	7	15	11 .1	-			2.6

Table 2:Gaseous emanations of germinating wheat seeds (stock material) on germination and growth of the bioassay material (jute) and the impact of 'wet' and 'dry' seed treatment on the germinability of invigorat ed (ME-D) wheat seed after ageing at 36% R.H. and 40°C for 6 months.

Treatments	Germinability of Wheat					Germinabillty of Jute			
	Cermination		Mean shoot lenQh (mm)	Mean *roof* length (mm)	Mean seedling length (mm)	Germination (%)	Mean shoot length (mm)	Mean root length (mm)	Mean seedllng length (mm)
	(%)	Are-am **yalue**							
Control (untreated)	30	33.2t	13	87	100 (52	86	4	6	10(30)
MED	93	74.66	24	123	147 (76)	91	7	10	17 (51)
ME-D + SD o	40	39.23	15	94	109 (56)	79	4	7	11(3)
ME-D * ME-D	52	46.15	18	104	122 (63)	82	5	8	13 (39)
ME-D	97	80.02	26	133	159	97	7	12	19 (57)

+BLP					(82)				
ME-D + CaCO,	82	64.90	23	1 21	144 (75)	88	6	10	16 (48)
ME-D + Iodine	83	65.65	23	1 20	193 (74)	88	6	10	16 (48)
M E-D + Methanol	92	73.57	25	1 28	153 (79)	94	7	I I	18 (34)
M E-D + Isopropanol	95	77.08	26	130	156 (81)	95	7	11	18 (54)
Control (non-aged)	98	81 .87	3 I	162	193 (100)	95	9	16	25 (75)
Blank						100		22	33 (100)
L.S.D at 0.05 P		15.8	5	15	5.9				1.5
L.S.D. at 0.01 P		21.7	7	1 9	8.2				2.1

Seed treatment research for higher yields and better crop performance in the field

Four-month-old seed was given mid-storage seed invigoration treatments to help it thrive. Earlier in the materials and technique section, we discussed wet and dry seed treatments. Midterm wet treatment is rehydrating the seeds to their original weight in a dehumidified environment before storing them in rubber-capped glass bottles for later planting. Both the hydrated-dehydrated seeds and the dry treated seeds were stored in the separate glass bottles with rubber stoppers. The control seeds were dried alongside the treatment seeds; they were not drenched nor dry dressed. Presown seeds were 8.5 months old and were kept in sealed glass bottles with a volume of 2.5 litres at room temperature. Before being planted, the hydrated (wet) seeds were just briefly air-dried.

(a) Productivity gains after midstorage therapy

Table shows that compared to the untreated control, plant density was much higher in plots where mid-storage hydration-dehydration was used. In terms of plant density, wet sand conditioning-drying outperformed other hydration-dehydration treatments. The dry treatments had a somewhat higher plant density than the control. Calcium carbonate treated with methanol proved to be the most effective medium for increasing plant density. Table shows that the number of tillers per unit area was considerably greater for the mid-storage wet treatments compared to the untreated control. When compared to other hydration-dehydration treatments, wet sand conditioning-drying produced the greatest number of tillers. The tiller density was increased just as effectively by dry treatments. Both plant height and panicle length were somewhat different between the treated and untreated seeds.

All hydration-dehydration treatments resulted in higher grain production per unit area compared to the untreated control. Soaking and drying produced the highest yield per area among the hydration-dehydration treatments. The effectiveness of dry dressing treatments in boosting field efficiency and output was also shown. Compared to the untreated control, the grain yield was significantly affected by the dry treatments of calcium hypochlorite and iodine (30 mg of iodine was thoroughly mixed with 3 g of calcium carbonate in a stoppered glass vial, kept for 24 hours, and then one kilogramme of seeds were dry dressed with the powdered material). Weight per 1000 grains was also improved by hydration-dehydration treatments . The dry dressing treatments also showed a little increase in 1000-grain weight compared to the control. In terms of 1000-grain weight, the dry treatments of calcium hypochlorite and iodine performed much better than the untreated control.

In addition to the positive impact that hydration alone (water soaking-drying) has on field performance and productivity, disodium phosphate has also been shown to increase grain yield. It has also been shown that moist treatments are superior than dry ones in enhancing yield and yield characteristics.

Table 3: Wheat field performance and yield as affected by mid-storage wet and dry treatments.

Treatments	**Plant population/m 2**	**Number of tillers/m'**	**Plant height (cm)**	**Length of panicle (cm)**	**Yield (g)/m2**	**1000 - grain weight (g)**
Control (untreated)	1 20	300	74.1	6.1	I 82.5	30.2
Wet treatment						
Water soaking-	137	353	81.0	8.5	203.2	33.2

drying						
Ascorbic acid soaking-drying	136	354	81.0	7.S	207.5	31.3
Sodium phosphate soakingfirying	147	399	82.0	7.2	211.2	31.1
Dipping-drying (water)	128	338	80.0	8.2	208.7	31.2
Moisture equilibration-drying	144	337	81.6	7.8	198.0	32.0
Moist sand conditioning-drying	152	396	80.9	8.1	200.0	33.2
Dry reatment						
Calcium carbonate	129	384	78.4	7.7	I 93.0	30.7
Calcium hypochlorite	127	363	76.2	8.0	198.2	31 .7
Iodine	129	358	77.8	8.2	197.1	31 .3
Methanol	135	355	78.5	8.3	193.0	30.2
lsopropanol	113	297	762	8.2	188.2	30.2
L.S.D. at 05 P	13	47	NS	NS	13.8	0.8

The impact of presowing treatment on yields

Field emergence seemed to be higher in the presowing treatments compared to the untreated control, but this difference was not statistically significant. When compared to the control and other treatments, the number of tillers produced by those subjected to water and wet sand conditioning was significantly higher. There was no statistically significant difference between the treated and untreated seed in terms of plant height or panicle length.

Table 4: Displays data showing a considerable increase in grain production per unit area for the soaking followed by moderately air-drying treatment compared to the control. It's worth noting that just increasing access to water has a significant impact on crop output. The 1000-grain weight likewise increased after water soaking, compared to the untreated control.

Treatments		Plant population/m 2	Number of tillers/m'	Plant height (cm)	Length of panicle (cm)	Yield (g)/m2	1000 - grain weight (g)
Control (untreated)		139	289	80.5	7.7	179.2	30.1
Wet treatment							
Water soaking-drying		151	405	82.3	8.4	204.2	33.3
Ascorbic acid soaking-drying		144	328	69.5	7.0	181.2	30.8
Sodium phosphate soaking		149	368	79.3	7.4	199.7	31.8
Dippin8 (water)		147	313	81.7	76	201.2	33.2
Moisture cqtiilibr«tion		149	3G4	79.7	7.5	202.5	32.8
Moist sand conditioning		148	409	81.2	7.6	199.5	33.1
Dry treatment							
Calcium carbonate		139	373	75.4	7.0	166.0	30.4
Calcium hypochlorite		t42	375	75.3	7.2	171.7	31 .4
Methanol		142	333	7G.G	6.8	171.7	32.2
Isopropanol		143	327	77. I	G.9	182.5	31 .4
L.S.D	at 0.05 P	NS	9 I	NS	NS	20.3	1.8

Wet and dry seed treatments: physiology investigations

Data reported in brackets in Table reveal that there was no significant increase in germination % when testing seeds immediately after dehydration. Soaking and drying the seeds had an effect on the membrane permeability measured by the electrical conductivity of the seed-steep water. The soaking-drying procedure significantly decreased the electrical conductivity of the leachate. However, neither moisture equilibration-drying nor any of the other dry treatments differed from the control in any measurable way. Because metabolites were lost during the soaking process, the electrical conductivity of the soaking-drying procedure decreased.

Increased membrane permeability was seen after 5 days of accelerated ageing, particularly in the untreated control seeds. To a lesser degree than in the moisture-equilibrated (ME-D), soaked dried (S-D), and dry dressed seeds, the electrical conductivity of the seed-steep water rose considerably related to age. Seeds treated with bleaching powder (calcium hypochlorite) had the lowest electrical conductivity, followed by those treated with isopropanol and methanol. However, the electrical conductivity was best when iodine was combined with calcium carbonate. The conductivity measurement of untreated control seeds was greatest, whereas that of non-aged seeds was lowest. Both gradual ageing at 36% RH and 40'C and natural ageing in ambient circumstances for 5 months had similar outcomes. Immediately after treatment (before ageing), a little difference was seen in electrical conductivity of seed-steep water and germination % between treated and untreated seeds in revitalised seed batches . However, the germination rate drops as electrolyte leakage rises with accelerated ageing.

It was discovered that moisture equilibration-drying followed by dry dressing treatments were superior to double wet treatments in preserving membrane integrity in reinvigorated seed by lowering electrolyte leakage. Wheat seeds treated with ME-D and then calcium hypochlorite exhibited the lowest leaching loss of electrolytes compared to other treatments . Slow ageing (dry ageing) seeds at 36% RH and 40°C yielded similar patterns to natural ageing seeds in the environment for 5 months. Electrolyte leakage was similarly reduced in the soaking-drying (S-D) treatment followed by dry-dressing with bleaching powder and alcohols compared to the untreated control. Electrolyte leakage could be reduced by soaking and drying alone, but S-D followed by dry treatment demonstrated much higher membrane integrity.

Table 5: The electrical conductance (y mhos/cm) of seed-Steep water of wheel seed (cv. Sonalika) was measured before and after ageing under different circumstances, and the results showed that the treatment had an effect.

Treatments	Before ageing (immediately after treatment)	Accelerated ageing (98% R.H and 40°C for 5 days)	Dry ageing (36% R.H and 40°C for 6 months)	Natural ageing (under ambient conditions for 5 months)
Control (untreated)	125 (98)	239 (45)	308 (27)	259 (38)
Soak ing-drying	81 (98)	138 (94)	168 (S3)	147 (98)
Moisture cquilibraticn-drying	108(97)	142 (92)	175 (92)	168 (95)
Calcium hypochlorite	109 8)	158 (91)	182 (88)	168 (95)
Calcium carbonate	105 (98)	165 (85)	224 (78)	199 (83)
Iodine	12 I (92)	188 (82)	231 (73)	203 (78)
Methanol	100 (97)	161 (87)	196 (83)	191 (88)
Isopropanol	109 (98)	! 63 (88)	i89 (87)	1 g2 (93)
Control (non-aged)	79 (100)	80 (97)	84 (98)	77 (98)
L.S.D. at 0.05 P	18.8	24.0	20.1	21.5
L.S, D. ct 0.01 P	25.9	33.1	27.5	297

4. Conclusion

The current study suggests that disodium phosphate (10'4M) be used in a midstorage wet treatment (hydration-dehydration) of stored wheat and Bengal gramme seed to preserve seed viability in storage and boost the crop's performance and yield in the field. When drying conditions are poor, dipping-drying and wet sand conditioning-drying are better options than soaking-drying for treating seeds. Instead of soaking-drying, a moist sand conditioning-drying treatment should be used on leguminous orthodox crop seeds like Bengal gramme to reduce soaking harm during hydration. It is possible to state here that presowing moist treatments would be ideal if the storage conditions are sufficiently acceptable.

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