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# Assessment of Seed Enhancement Treatments on Relative Storability of Wheat Grain Produced under Zero Tillage Technique comprises Conventional Tillage

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**ABSTRACT: The most initial critical stage of crop grow this germination of seeds and uniform plant population stand in the field that determine the yield potential. Productivity is especially frequently hampered under suboptimal situation which primarily attributed to uneven or poor germination and have asynchronous seedling emergence. Seed produced under zero tillage technique leads to moisture stress as well as temperature stress in the field condition which might reflect the vigour potential of seed. It has been notice that stress (due to moisture) has deleterious consequence effects on germination and viability of seeds. The relative storability of seed lot harvested from two different tillage condition sown after the seed enhancement treatments was assessed by the standard germination, vigour indices and electrical conductivity after six months of storage in the gunny bag under ambient condition. Seed vigour potential and electrical conductivity of seed lot produced under zero tillage technique was inferior to that of conventional or normal tillage. Seed treatments had significantly enhanced the storability of seed lot harvested from both tillage techniques due to increased capacity of treated seeds to resist adverse ageing condition.**

**Keywords:** Moisture stress, Seedling emergence, Seed priming, Viability.

## INTRODUCTION

Seed production of wheat crop usually been taken place in normal tillage (NT) condition; however due to focus on resource conservation and reduction in the cost of seed production in different types of soil with moisture constrained status, it is being grown in zero tillage (ZT) also. Nowadays, agriculture is frequently facing the problem of water shortage as well as reduction in crop growing period. Hence to avoid moisture stress and escape from terminal heat stress, wheat is generally cultivated under zero tillage condition. The cultivation of seed crops under zero tillage condition frequently encounters moisture stress conditions during germination, seedling establishment which might results into poor plant population in field. The productivity of the seed crop is generally affected by low plant population in the field.

Seed quality is vital for sustainable production system and food assurance. Seed enhancements comprise physiochemical and biological treatments to improve the germination percentage by uniformity in emergence and vigour seedling, increased germination rates due to reduced time of emergence by earlier begin of metabolic activities of hydrolytic enzymes as well as resource mobilization (Afzal *et al.,* 2016). Globly, wheat is a one of the most important cereal crop as well as choice food. Next to china, India is the second largest producer of wheat and in its acreage, production and productivity in India is about 31.45 Mha, 107.87 MT and 34.21q $ha^{-1}$ respectively, (Anonymous, 2020-21). Seed is a basic input and take part in a vital role in sustainable crop production (Schwinn, 1994). A good quality seed can increases the yield potential of crop upto 5-20 per cent. Across in the Southern Asia, rice-wheat cropping system is most prevailed and productivity of wheat is decline due to late sowing, delayed harvesting of rice, short growing period of winter seasons, less developed and improper irrigation facilities and poor crop stands due to lack of optimal moisture. The availability of good quality irrigation water is decreases with time due to higher rate of population pressure, industrialization and urbanization as well uncivilized lifestyle. The groundwater of country is being depleted, rainwater is being paid wasted, and surface water is being to be polluted (Sagasta *et al.,* 2017). In this context, we have adopted the concept of resource conservation agriculture both for grain as well as seed production. Zero tillage is one of the resource conservation techniques and mainly emphasized on moisture conservation during crop production. Several researchers have previously reported that seed enhancement treatment with certain agro-chemical agents is improving its seed quality

parameters. Harris, (1996) demonstrated that pre sowing of soaked seed in the plain water could enhanced the uniformity in germination and emergence, leading to better crop stands, and stimulated seedling growth much more vigorously. The another researcher Taylor *et al.*, (1998) noticed that in pre sowing, seeds are soaked in diverse solutions that have high osmotic potential which ultimately check the seeds to absorbample amount of water for better radical protrusion, which is suspending the seeds in the lag phase. Pre sowing seed enhancement treatment has been commonly used to reduce the time between seed sowing and seedling emergence and to synchronize emergence (Moosavi *et. al.*, 2009).

## MATERIAL AND METHODOLOGY

In rabi season 2016-17, the study conducted at Bihar Agricultural College research farm, Sabour. Single seed lot of popular wheat variety DBW-14 was treated with various seed enhancement treatment viz., Control ($T_0$), $KNO_3$, (2.0 %, 18hrs ($T_1$), Hydration-dehydration, 8hrs ($T_2$), $CaCl_2$ 2.0%, 12hrs ($T_3$), Seed dressing with Bavistin @2 g $kg^{-1}$ of seed ($T_4$), Hydration with $KNO_3$ (2.0%) in succession of Bavistin @2 g $kg^{-1}$of seed ($T_5$), Hydration with distilled water in succession of Bavistin @2 g $kg^{-1}$ of seed ($T_6$), Hydration with $CaCl_2$ (2.0%) in succession of Bavistin @2 g $kg^{-1}$ of seed ($T_7$). Seed enhancement treatment was effectively soaked in tap water with required quantity of seeds with various chemicals for different duration in proposition of 1:2 (Kg of seeds: volume of solution) using wet gunny bag. Then, seed treated or primed seeds were dried in the shade to maintain the seed moisture content approximately upto 12 to 13 per cent. Seed Treated were grown in the plot area of 7 × 4 $m^2$ with a recommended spacing of 20 × 10 cm and adjusted in sixth number of plot. The seeds (treated seeds along with untreated) grown in two separate experiments for normal and zero tillage conditions and crops were raised with recommended package and practices. Collected seed samples were examined for the quality cheek parameters on 100 seed weight (g), germination percentage, seedling dry weight (mg), seedling length (cm), Seedling vigour index-I (Germination × seedling length), Seedling vigour index-II (Germination × Seedling dry weight), (Abdul-Baki and Anderson, 1973), mean emergence time (MET), (Ellis and EH, 1980) and field emergence index (FEI), (Maguire, 1962).

## RESULTS AND DISCUSSION

The seed enhancement treatments have already been proven to improve germination and vigor potential of seed lot in several crops that contributes to the better crop establishment in the field under both the tillage condition.

**Effect of tillage condition:** The seeding length, seedling dry weight,100 seed wt, germination %, vigour index-I, vigour index-II, MET and FEI was observed significantly more in seed lot harvested from normal tillage (B1), (3.42, 95.54, 19.30, 41.41, 1844.72, 3939.27, 5.34, 82.09 respectively) than in zero tillage (B2), (3.36, 94.21, 17.90, 39.53, 1687.23, 3725.98, 5.55, 80.28 respectively). The mean germination time of stored grain seeds varies between 5.4 to 8.9 days (Thapliyal *et al.*, 2021). In (Table 1) it is found ( 1.78, 1.41, 7.25, 4.75, 9.33, 5.72, 3.78, 2.25) respectively that per cent increase over zero tillage condition for 100 seed weight, germination per cent, seeding length, seedling dry weight, vigour index-I, vigour index-II, MET and FEI. Enhancement of seed by various treatments became physiologically advanced by carrying out the initial step of germination, thus improving the subsequent germination ability and crop establishment in the field. The standard germination percentage was enhanced by all the treatment viz. T1, T2, T3, T4, T5, T6 and T7 in the range of 1.80-5.76 (NT), 3.30-7.36 (ZT) respectively under both the tillage condition (Table 1, Fig. 1). Treatment T1 (5.76, 7.36) recorded highest increment in standard germination throughout both the tillage condition followed by T4 (4.32) in NT and T5 (6.25) in ZT. Treatment T3 (1.80, 3.30) showed the lowest increment in standard germination in both the tillage techniques.

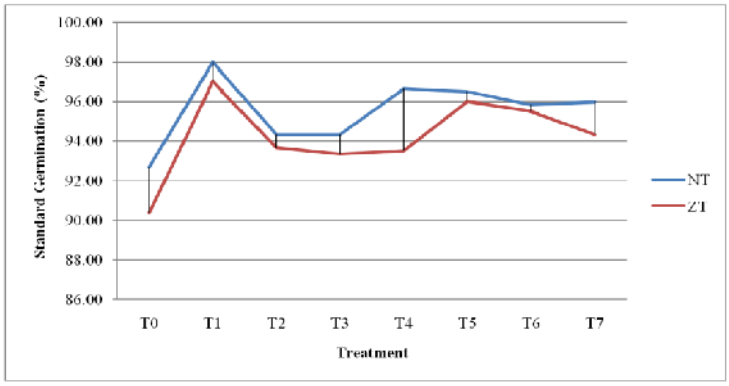


**Fig. 1.** Effect of seed enhancement treatment on standard germination (%) in both tillage techniques.

**Table 1: Mean values for different laboratory parameters in both tillage techniques.**

| | 100 Seed weight (g) | Standard Germination (%) | Seedling Length (cm) | Seed Dry Weight (mg) | Vigour Index-I | Vigour Index-II | Mean Emergence Time | Field Emergence Index |
|---|---|---|---|---|---|---|---|---|
| Normal Tillage (B1) | 3.42 | 95.54 | 19.30 | 41.41 | 1844.72 | 3939.27 | 5.34 | 82.09 |
| Zero Tillage (B2) | 3.36 | 94.21 | 17.90 | 39.53 | 1687.23 | 3725.98 | 5.55 | 80.28 |
| CD (0.01) | **0.049** | **1.200** | **0.295** | **0.571** | **39.215** | **72.938** | **0.275** | **1.284** |

**Effect of normal tillage on seed enhancement treatments:** The seed enhancement with all pre sowing treatment were recorded significant that gradually improve the seed quality in terms of 100 seed wt, Germination %, length of seedling, seedling dry wt, seed vigour index-I, seed vigour index-II, MET and FEI of wheat crop when was raised with normal tillage (Table 2).

**Table 2: Mean values for seed vigour parameters in both tillage techniques.**

| Treatments | 100 Seed weight (g) | Standard Germination (%) | Seedling Length (cm) | Seed Dry Weight (mg) | Vigour Index-I | Vigour Index-II | Mean Emergence Time | Field Emergence Index |
|---|---|---|---|---|---|---|---|---|
| Normal Tillage (**$B_1$**) | | | | | | | | |
| **$B_1T_0$** | 3.18 | 92.67 | 18.10 | 41.4 | 1677.40 | 3718.77 | 6.18 | 77.03 |
| **$B_1T_1$** | 3.56 | 98.00 | 20.73 | 42.4 | 2032.00 | 4272.20 | 4.36 | 88.14 |
| **$B_1T_2$** | 3.42 | 94.33 | 18.45 | 41.6 | 1740.64 | 3847.93 | 5.42 | 86.15 |
| **$B_1T_3$** | 3.43 | 94.33 | 19.67 | 39.6 | 1854.20 | 3741.87 | 5.52 | 77.37 |
| **$B_1T_4$** | 3.34 | 96.67 | 19.19 | 39.2 | 1855.56 | 3847.83 | 5.24 | 82.07 |
| **$B_1T_5$** | 3.57 | 96.50 | 19.57 | 43.6 | 1888.35 | 4200.07 | 5.21 | 82.73 |
| **$B_1T_6$** | 3.42 | 95.83 | 19.09 | 41.4 | 1829.61 | 3943.13 | 5.63 | 78.61 |
| **$B_1T_7$** | 3.46 | 96.00 | 19.58 | 40.4 | 1880.02 | 3942.33 | 5.16 | 84.62 |
| Zero Tillage (**$B_2$**) | | | | | | | | |
| **$B_2T_0$** | 3.15 | 90.35 | 16.92 | 37.67 | 1528.85 | 3402.60 | 6.34 | 76.03 |
| **$B_2T_1$** | 3.43 | 97.00 | 18.63 | 41.47 | 1806.86 | 4022.60 | 5.35 | 86.44 |
| **$B_2T_2$** | 3.33 | 93.67 | 17.81 | 39.93 | 1668.04 | 3739.73 | 5.61 | 79.22 |
| **$B_2T_3$** | 3.38 | 93.33 | 17.89 | 38.80 | 1669.92 | 3621.87 | 5.39 | 77.73 |
| **$B_2T_4$** | 3.36 | 93.50 | 17.61 | 39.30 | 1647.30 | 3675.40 | 5.82 | 82.03 |
| **$B_2T_5$** | 3.45 | 96.00 | 18.40 | 40.20 | 1765.78 | 3860.60 | 5.55 | 76.07 |
| **$B_2T_6$** | 3.36 | 95.50 | 17.82 | 39.87 | 1702.75 | 3805.77 | 5.37 | 79.18 |
| **$B_2T_7$** | 3.39 | 94.33 | 18.11 | 39.00 | 1708.31 | 3679.30 | 5.49 | 85.55 |
| **CD (0.01)** | **0.077** | **NS** | **0.661** | **1.404** | **112.991** | **224.824** | **0.777** | **3.632** |

Similar findings were observed by Kathiresan *et al.*, (1984); Farooq *et al.*, (2006b); Afzal *et al.*, (2007); Abbasdokht *et al.*, (2010); Hanegave *et al.*, (2011); Singh *et al.*, (2017).

Treatment with $KNO_3$ (2.0 %) results in maximum percent improvement over control for 100 seed wt, germination %, length of seedling, seedling dry wt, seed vigour index-I, seed vigour index-II, FEI and MET showed percent improvement 11.95, 5.76, 14.55, 8.65, 21.14, 14.88, 14.42 and reduction of 29.45 with values of 3.56 g, 98.00 percent, 18.10 cm, 43.60 mg, 2030.00, 4272.20, 88.14 and 4.36 days, respectively. Similar findings were observed by Ahmadvand *et al.*, (2012); Ghobadi *et al.*, (2012); Singh *et al.*, (2017); Ajirloo *et al.*, (2013).

The best next treatment was $KNO_3$ (2.0%) followed by seed dressing with bavistin which show significantly better performance and at par to $KNO_3$ for improving the 100 seed wt, germination, seedling length, seedling dry weight, seed vigour index-I, seed vigour index-II, FEI and MET shown percent improvement of 12.26, 4.14, 19.57, 8.47, 12.58, 6.03, 15.70 and reduction of 7.40 with values of 3.57 g, 96.50 percent, 19.57 cm, 43.53 g, 1888.35, 4200.07, 82.73 and 5.21 days respectively, over control. These results were reported by Farooq *et al.*, (2006a); Ghobadi *et al.*, (2011); Toklu *et al.*, (2015); Yucel *et al.*, (2012); Adinde *et al.*, (2016); Patel *et al.*, (2017).

Seedling vigour index was higher in healthy seeds (Singh *et al.*, 2021). The vigour indices (VI-I & VI-II) are important parameters of seed quality which directly affect the field establishment and all the treatment had enhanced both the vigour indices. The treatment *viz.* $T_1$, $T_2$, $T_3$, $T_4$, $T_5$, $T_6$ and $T_7$ enhanced the VI-I in the range of 3.77-21.14 percent (NT), 7.75- 18.18 percent (ZT) (Table 1, Fig. 2). Treatment $T_1$ (21.14, 18.18) reported the highest percent increment in VI-I followed by $T_5$ (12.58, 15.50). Treatment $T_2$ (3.77) showed the lowest increment in VI-I in NT and $T_4$ (7.75) in ZT.

The treatment *viz.* $T_1$, $T_2$, $T_3$, $T_4$, $T_5$, $T_6$ and $T_7$ enhanced the VI–II in the range of 0.62-14.88 % (NT), 3.53-18.22% (ZT) (Table 1, Fig. 3). Treatment $T_1$ (14.88, 18.22) had recorded highest increment in VI-II which was followed by $T_5$ (12.94, 13.46). Treatment $T_3$ (0.62) showed the lowest increment in VI-II in NT and $T_7$ (3.53) in ZT.

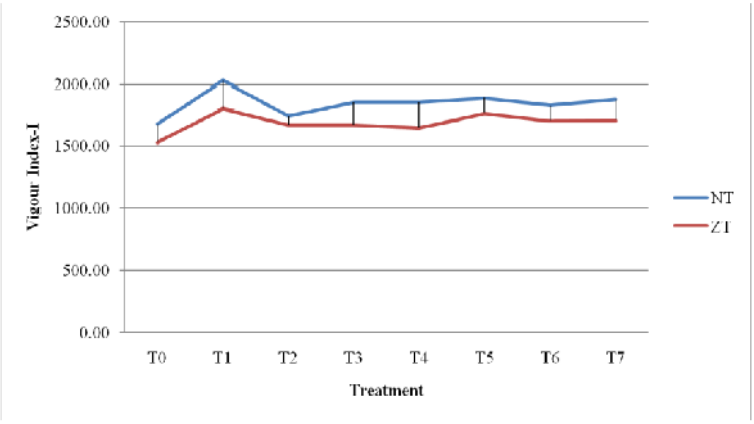


**Fig. 2.** Effect of seed enhancement treatment on vigour index-I in both tillage techniques.

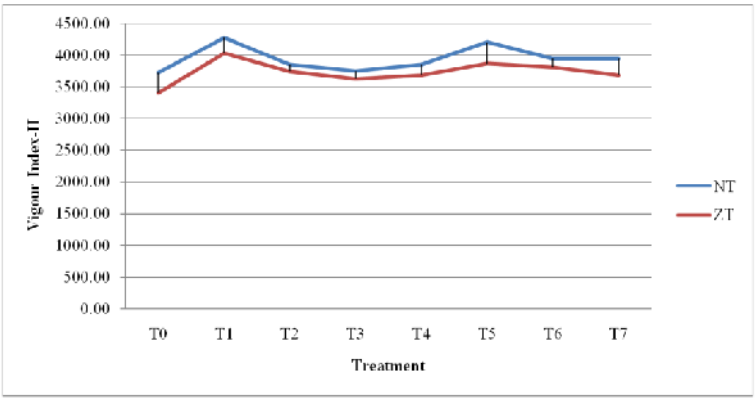


**Fig. 3.** Effect of seed enhancement treatment on vigour Index-II in both tillage techniques.

The seed enhancement treatments had enhanced all seed quality parameters in both the tillage condition. Several researchers had also found the almost similar results in the several crops with different seed enhancement treatments like (Kuchlan *et al.*, 2002) in sunflower crop; (Sarkar *et al.*, 2002) in soybean. Singh *et al.*, (2017) observed that seeds treatment with $KNO_3$ (2.5%) on Mandakini (K-9351) of wheat variety significantly enhanced the seed quality with percent increment in 1000 seed wt, germination%, seedling length, seedling dry wt, seedling vigour index-I and seedling vigour index-II.

Several methods like that seeds with hydro-priming and osmo-priming have been employed earlier to enhance the germination ability and vigor potential in the different crops like in moong bean (Maity *et al.*, 2000), okra (Singh *et al.*, 2004) and bitter gourd (Pandita and Nagarajan 2004). Ajirloo *et al.*, (2013) reported in forage maize that a number of seed priming techniques such as hydro-priming (soaked distilled water), hydropriming with $KNO_3$ and $CaCl_2$ (1.0%), significantly affected the fresh wt, shoot length, number of roots, root length, vigor index, time emergence(start), time to 50 per cent emergence and emergence energy.

Hanegave *et al.*, (2011) conducted the seed quality of maize subjected to hydropriming, hydropriming + thiram (0.25%), $KNO_3$ (0.2%), $CaCl_2$ (2.0%), KCl (100 ppm) and $KH_2PO_4$ (1.0%) and reported improvement in germination percentage, germination speed, root length, shoot length, seedling dry wt and seedling vigour index. Shehzad *et al.*, (2012) reported that seed treatments with $KNO_3$ and $CaCl_2$ (1.0%), significantly affected the fresh wt, root and shoot length, number of shoots, vigor index, emergence time (to start), time to 50 per cent emergence of forage sorghum.

In sunflower, seed hardening with $KNO_3$ (500 ppm) was found better to alleviate water stress on germination ability than other agro-chemicals (Kathiresan *et al.,* 1984). Soybean seeds primed with salt solutions of $CaCl_2$ (0.5%), $KH_2PO_4$ (50ppm) and plant growth hormone (GA3) were found to significantly enhanced germination, vigor indices and higher speed of germination (Kiros *et al.,* 2008). The highest germination percentage, germination speed, vigour index-I and vigour index-II were observed in hydro-priming treatment in cowpea (Krishnakumary *et al.,* 2008). Sarlach *et al.,* (2013) observed in wheat, that the treatment, $CoCl_2$ (15µg/ml) and $KNO_3$ (2.0%) after 24 hrs of seed priming were at par in respect to the length of seedling (238 and 240), seedling fresh wt (172 mg and 168 mg) and seedling vigour index (22610 and 22800). Commonly in both the tillage condition, the treatment T1 ($KNO_3$, 2.0%) was found the most promising i.e. enhance the physiological parameters significantly superior over control. The beneficial effects of $KNO_3$ (2.0%) is attributed to increase ionic strength and cytochrome oxidase activity. The occurrence of nitrate in $KNO_3$ provides supplementary substrate for ageing accelerator and synthesis of protein for enhancing the germination during seed enhancement treatment and also helps in system of membrane repair mechanism (Khan *et al.,* 1978).

**Zero tillage:** The effect of zero tillage after treatment of seed with various pre-sowing seed enhancement treatments, resulting in enhancement of quality seed for 100 seed wt., seed germination, length of seedling, seedling dry wt., seed vigour index-I, seed vigour index-II, MET and FEI (Table 2). Poor crop development is the major issues in production under zero tillage technique. Seed treatments with KNO3 significantly improved the quality seed parameters with percentage increase of 8.89, 7.36, 10.09, 10.09, 18.18, 18.22, 13.69 and reduction of 12.62 in 100 seed wt, seed germination, seedling length, seedling dry wt., seed vigour index-I, seed vigour index-II, FEI and MET, respectively over control with values of 3.43 g, 97 percent, 18.63 cm, 41.47 mg, 1806.86, 4022.60, 5.35 days and 86.44 respectively.

More better results were exhibited with treatment $KNO_3$ (2.0 %) followed by seed dressing with bavistin next to $KNO_3$ and statistically at par to $KNO_3$ for 100 seed wt, seed germination, seedling length, seedling dry wt, seed vigour index-I, seed vigour index-II, FEI and MET with percentage increment of 9.52, 6.25, 8.73, 6.72, 15.50, 13.46, 0.05 and reduction of 12.46 over untreated seeds with value of 3.45 g, 96.00 percent, 17.82 cm, 39.87 mg, 1702.75, 3805.77, 79.18 and 5.37 days, respectively.

The data of experiment clearly indicated that control seeds exhibiting significantly inferior quality seed while, Seed treated with $KNO_3$ (2.0%) exhibited better quality in succession of $CaCl_2$ (2%), $CaCl_2$ (2.0%). The seeds exhibited good storage potential by maintain the viability for longer duration in optimum storage situation (Thapliyal *et al.,* 2021).

## CONCLUSION

Seed vigour potential of seed lot produced under zero tillage technique was comparatively inferior to that of normal tillage. Further seed enhancement treatment improves the seed vigour potential in both the tillage techniques. Almost all the treatment has been improved seed vigour potential significantly over control. Among all the treatments, $KNO_3$ (2.0 %) was found to be best which was also at par with $KNO_3$ (2.0 %) in succession with seed dressing with Bavistin in both the tillage condition.

**Conflict of Interest**. None.

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