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Effect of polymer and plant protectants based seed treatment on crop performance in wheat (*Triticum aestivum* L.)

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Abstract

A field experiment was undertaken to extrapolate the effect of different polymer and plant protectants based seed treatment on yield and yield components of wheat (Triticum aestivum cv. HPW-155). Results interpret that different polymer based seed treatment had significant effect on tillers per plant, plant height (cm), spike length (cm), spikes per plant, spikelet per spike, seeds per spike, 1000-seed weight (g), seed yield per plot (kg), seed yield (q/ ha) except days to 50% flowering and days to 75% maturity which had shown non-significant differences. Treatments, T_6 - polymer + Vitavax 200 @ 2 g/Kg of seed and T_5 - Vitavax 200 @ 2 g/Kg seed had shown significant superiority for tillers per plant, plant height (cm), spike length (cm), spikes per plant, spikelets per spike, 1000 - seed weight, seed yield per plot (kg), and seed yield (q/ ha) over control (T_1 - control). Treatment T_6 had shown 14.7% gain in seed yield as comapred to untreated control(T_1).

Keywords: Crop performance, polymer coating, seed, wheat, 1000 seed weight

1. Introduction

Wheat (Triticum aestivum L.) is a cereal grass of the gramineae family having its geographical origin in Middle East (Miller, 1987). It is a leading food crop that has been described as the 'King of Cereals' because of its acreage, high productivity and the prominent position in the International food grain trade. Wheat provides a large fraction of the dietary protein and total food supply, and is grown throughout the world, in a wide variety of climates. Modern seed production system requires a high degree of precision in crop establishment. The need for high plant population density and uniform plant stand requires high quality wheat seed that will consistently produce rapid and uniform seedlings. The use of high quality seed is among the best practices for obtaining maximum crop yield. These seeds are more likely to achieve a high performance when exposed to different environmental conditions, expressed in a high per centage and speed of emergence, good stand establishment, good initial

seedling development and increased final production (Tillmann and Miranda, 2006). It is the seed physiological and sanitary quality which determines their performance in the field i.e. the proper establishment of plants that is essential for satisfactory level of productivity and final product quality (Nascimento, 2011). After sowing, seeds are still exposed to biotic and abiotic environmental factors (Delouche, 2005) and agricultural soils have many pathogenic microorganisms that may interact with seeds and seedlings (Munkvold and O'Mara, 2002) and reduce their performance by causing seed rot, root rot and seedling death (Pinto, 2000). Phytophagous insects in the soil can also damage seedlings (Girolami, 2009) and significantly reduce the plant population. Under these conditions seed treatment with polymer, fungicides and insecticides is an ideal approach for improving seed and seedling performance of wheat under field conditions. Keeping this in the view present research was formulated



to study the effect polymer based different seed treatment on crop performance in wheat.

2. Materials and Methods

The current study was conducted at Department of Seed Science and Technology, CSKHPKV Palampur. Seed treatment was done manually during December 2018 on carry over seeds of rabi 2017-18 seasons and achieved uniform coating of seeds. Ten treatments viz; T, - untreated control, T2 - polymer coating (Polykote @ 3 ml/Kg) of seed, T₃ - flowable Thiram (Royal flow 40SC) @ 2.4 ml/ kg, T₄ - polymer + flowable Thiram (Royal flow 40 SC) @ 2.4 ml/Kg seed, T₅ - Vitavax 200 (containing Thiram 37.5% and Carboxil 37.5%) @ 2 g/Kg seed, T_6 - polymer + Vitavax 200 (containing Thiram, 37.5% and Carboxil, 37.5%) @ 2 g/Kg of seed, T₇ - Imidacloprid (Gaucho) @ 4 ml/Kg seed, T₈ - polymer + Imidachloprid (Gaucho) @ 4 ml/Kg seed, T_9 - polymer + flowable Thiram (Royal flow 40 SC) @ 2.4 ml/Kg seed + Imidacloprid (Gaucho) @ 4 ml/Kg seed, T₁₀ - polymer + Vitavax 200 (containing Thiram, 37.5% and Carboxil, 37.5%) @ 2 g/Kg of seed + Imidacloprid (Gaucho) @ 4 ml/Kg seed were evaluated in randomized block design (RBD) with three replications after one year of storability. Ten plants from each plot were selected randomly to record the data on days to 50% flowering, days to 75 % maturity, tillers per plant, plant height (cm), spike length (cm), spikes/spike, spikelets per spike, seeds per spike, 1000 seed weight (g), seed yield/plot (kg), seed yield (q/ha). The recorded data was statistically analyzed using software OPSTAT(Sheoranet al., 1998)

3. Results and Discussion

The statistically analyzed data showed that different seed treatments significantly influenced the tillers per plant, plant height (cm), spike length (cm), spikes per plant, spikelets per spike, seeds per spike, 1000 seed weight (g), seed yield per plot (Kg) and seed yield (q/ ha). Days taken to 50 per cent flowering did not differ significantly due to different seed treatments. However, the lowest number of days taken to 50 per cent flowering was obtained in $\rm T_6$ - polymer + Vitavax 200 @ 2 g/Kg of seed (123.00), while the highest days was recorded in $\rm T_1$ - control (126.00) and $\rm T_4$ - polymer + flowable Thiram @ 2.4 ml/Kg seed (126.0) (Table 1). Similar trends were reported in days to 75 per cent maturity which does not differ significantly due to different seed treatments (Table 1). Similar results were reported by Raju *et al.* (2019) who had recorded that

polymer and Thiram had non - significant influence on days to maturity in maize.

The number of tillers per plant recorded was significantly influenced by different seed treatments. Significantly higher tillers per plant over T₁ - control (2.40) was observed for the treatment $T_{\rm 6}$ - (4.80), followed by $T_{\rm 5}$ - (4.46), T_8 - (3.93), T_7 - (3.60), T_{10} - (3.40), T_3 - (3.20), T_2 - polykote @ 3 ml/Kg of seed (3.00), T_9 - (2.80) and T₄ - (2.65) (Table 1). Similar results are recorded by Tiwari et al. (2015) and Freiberg et al. (2020) in wheat. Plant height varied significantly for all the treatments. Average plant height recorded was 95.54 cm. Significantly higher plant height in comparison to T₁ - control (92.00 cm) was recorded for treatment T_6 - (98.47 cm) followed by T_5 - (98.00 cm), T_8 - (97.44 cm), T₇ - (96.56 cm), T₁₀ - (95.93 cm), T₃ - (95.16 cm), T_{2} - (94.70 cm), T_{3} - (94.00) and T_{4} - (93.23 cm) (Table 1). Similar results were reported by Sumalata et al. (2017) and Sharma et al. (2017) in maize.

The spike length was significantly influenced by different seed treatments. Significantly higher spike length was recorded for T $_6$ - (12.30 cm) followed by T $_5$ - (11.73 cm), T $_8$ - (11.13 cm), T $_7$ - (10.44 cm), T $_{10}$ - (9.93 cm), T $_3$ - (9.46 cm), T $_2$ - (8.86 cm), T $_9$ - (8.57) and T $_4$ - (8.28 cm) (Table 1). Significantly higher spikes per plant was observed for the treatment T $_6$ - (4.60) followed by T $_5$ - (4.20), T $_8$ - (3.80), T $_7$ - (3.52), T $_{10}$ - (3.20), T $_3$ - (2.97), T $_2$ - (2.75), T $_9$ (2.54) and T $_4$ - (2.33) (Table 1). Similar results are recorded by Tiwari *et al.* (2015) in wheat.

The numbers of spikelets per spike was significantly influenced by different seed treatments. Significantly higher spikes was observed for treatment T_6 (18.60) followed by T_5 (18.20), T_8 (18.00), T_7 (17.80), T_{10} (17.60), T_3 (17.40), T_2 (17.20), T_9 (17.00) and T_4 (16.90) (Table 1). Significantly higher seeds per spike were observed for treatment T_6 (46.50) followed by T_5 (45.50), T_8 (45.00), T_7 (44.50), T_{10} (44.00), T_3 (43.50), T_2 (43.00), T_9 (42.50) and T_4 (42.25) (Table 1 and Fig. 1). Similar results were reported by Tiwari $\it et~al.$ (2015) in wheat.

Average weight of 1000 seeds recorded for all treatments was 49.11 g. Significantly higher 1000 seed weight was recorded for all the treatments in comparison to $\rm T_1$ -control (47.00 g). $\rm T_6$ (51.37 g) of seed exhibited highest 1000 seed weight followed by $\rm T_5$ (50.77 g), $\rm T_8$ (50.22 g), $\rm T_7$ (49.83 g), $\rm T_{10}$ (49.34 g), $\rm T_3$ (49.00 g), $\rm T_2$ (48.33 g), $\rm T_9$ (47.92



Table. 1 Effect of different seed treatments on crop performance in wheat

Treatments	DAS 50% flowering	Days to 75% maturity	Tillers /plant	Plant height (cm)	Spike length (cm)	Spikes /plant	Spikelets /spike	Seeds /spike	1000 seed weight	Seed yield /plot	Seed yield (q/ha)
T1	126.00	167.00	2.40	92.00	8.00	2.10	16.80	42.00	47.00	1.50	45.45
T2	124.00	165.00	3.00	94.70	8.86	2.75	17.20	43.00	48.33	1.59	48.18
Т3	124.00	165.00	3.20	95.16	9.46	2.97	17.40	43.50	49.00	1.61	48.78
T4	126.00	166.00	2.65	93.23	8.28	2.33	16.90	42.25	47.37	1.55	46.96
Т5	124.00	165.00	4.46	98.00	11.73	4.20	18.20	45.50	50.77	1.70	51.51
T6	123.00	164.00	4.80	98.47	12.30	4.60	18.60	46.50	51.37	1.72	52.12
T7	124.00	165.00	3.60	96.56	10.44	3.52	17.80	44.50	49.83	1.65	50.00
Т8	124.00	165.00	3.93	97.44	11.13	3.80	18.00	45.00	50.22	1.67	50.60
Т9	125.00	166.00	2.80	94.00	8.57	2.54	17.00	42.50	47.92	1.57	47.57
T10	124.00	165.00	3.40	95.93	9.93	3.20	17.60	44.00	49.34	1.63	49.39
Mean	125.40	165.40	3.42	95.54	9.87	3.20	17.55	43.87	49.11	1.62	49.06
C.V.	0.881	0.775	3.05	0.27	1.66	4.68	0.35	0.36	0.64	0.31	0.32
SE(m)	0.632	0.740	90.0	0.15	0.09	0.09	0.03	0.09	0.18	0.003	0.093
C.D.	\mathbf{N}	\mathbf{N}	0.18	0.45	0.28	0.20	0.10	0.20	0.54	0.001	0.27

T₁ – control (untreated seeds), T₂ – polymer coating (polykote @ 3ml/Kg of seed, diluted with 5 ml of water), T₃ – flowable Thiram (Royal flow 40 SC) @ 2.4 ml/Kg seed, T₄ – polymer + flowable Thiram 37.5% and Carboxyl 37.5% geed, T₂ – polymer + flowable Thiram (Royal flow 40 SC) @ 2.4 ml/Kg seed + Imidacloprid (Gaucho) @ 4 ml/Kg seed, T₉ – polymer + flowable Thiram (Royal flow 40 SC) @ 2.4 ml/Kg seed + Imidacloprid @ 4 ml/Kg seed + Imidacloprid (Gaucho) 4 ml/Kg seed



g), and T_4 (47.37 g) (Table 1 and Fig. 1). Similar results were reported by Shakuntla *et al.* (2010) in sunflower, Selvakumar *et al.* (2015) in wheat, Sumalata *et al.* (2017) in maize and Sharma *et al.* (2017) in maize.

Average seed yield per plot across various treatments was recorded as 1.62 Kg perplot. Significantly higher seed yield per plot in comparison to T, control (1.50 Kg) was recorded for treatment T₆ (1.72 Kg), followed by T_5 (1.70 Kg), T_8 (1.67 Kg), T_7 (1.65 Kg), T_{10} (1.63 Kg), T_3 (1.61 Kg), T_2 (1.59 Kg), T_0 (1.57 Kg), and T_4 (1.55 Kg) (Table 1). Similar results were reported by Chikkanna et al. (2000) in groundnut, Shakuntla et al. (2010) in sunflower, Sumalata et al. (2017) and Sharma et al. (2017) in maize. The seed yield per hectare was computed from the seed yield per plot. Significantly higher seed yield (q/ha) in comparison to T, control (45.45 unit q/ ha) was recorded in T_6 (52.12 q), followed by T_5 (51.51 q), T_8 (50.60 q), T_7 (50.00 q), T_{10} (49.39 q), T_3 (48.78 q), T_2 (48.18 q), $T_{0}(47.57 \text{ q})$, and $T_{4}(46.96 \text{ q})$ (Table 1 & Fig 1). Similar results are reported by Kumar et al. (2014) in pigeon pea, Tiwari et al. (2015) in wheat, Sumalata et al. (2017), Bony et al. (2017) in soybean and Sharma et al. (2017) in maize.

During present study better spikes per plant, spikelets per spike, 1000-seed weight and seed yield (q/ ha) was recorded for seed treatments with polymer and fungicides. Therefore, seed treatments with polymer and fungicides could be used to enhancing seed yield of wheat seeds.

4. Conclusion

Results had shown that different polymer based seed treatment had significant effect on tillers per plant, plant height (cm), spike length (cm), spikes per plant, spikelet per spike, seeds per spike, 1000-seed weight (g), seed yield per plot (Kg), seed yield (q/ ha) except days to 50% flowering and days to 75% maturity which had shown non-significant differences. Treatment T₆ polymer + Vitavax 200 @ 2 g/Kg of seed and T₅ Vitavax 200 @ 2 g/Kg seed had shown significant superiority for tillers per plant, plant height (cm), spike length (cm), spikes per plant, spikelets per spike, 1000 - seed weight, seed yield per plot (Kg), and seed yield (q/ha) over control (T₁). Polymer based seed treatment (T₆) had shown 14.7% gain in seed yield over control (T₁) followed by 13.3% under treatment T₅ Vitavax 200 @ 2 g/Kg seed (Fig 1).

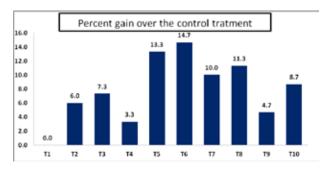


Fig. 1. Percent gain of treatments over control

It can be concluded that to get better crop performance seeds of wheat can be either be treated with polymer coating @ 3 ml/Kg of seed + Vitavax 200 @ 2 g/Kg of seeds or Vitavax 200 @ 2 g/Kg of seed.

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Conflict of Interest

Authors declare that they have no conflict of interests.

Ethical Compliance Statement

NA

Author's Contribution

Conceptualization of research (AT, KCD, RK); Designing of the experiments (KCD, RK, AT); Contribution of experimental materials (KCD, AT); Execution of field/lab experiments and data collection (AT, KCD, RK); Analysis of data and interpretation (KCD, RK, AT); Preparation of the manuscript (AT, KCD, RK).

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