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RESEARCH PAPER

Enhancement in seed quality, growth and yield of wheat (*Triticum aestivum* L.) through polymer seed coating

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Abstract : Field experiments were conducted for two consecutive years (2009-10 and 2010-11) during *Rabi* seasons at the research farm of Directorate of Seed Research, Mau to study the effects of polymer seed coating along with insecticide, bio-agent and natural fillers on seed quality parameters, growth and yield of wheat. One year old seeds of two wheat varieties (HUW-234 and HD- 2824) were coated with 5 different treatments *viz.*, polykote @ 3 ml/kg seed alone (T_1), polykote @ 3 ml/kg + *Trichoderma viride* @ 3 g./kg seed (T_2), polykote @ 3 ml/kg + insecticide (carbaryl) @ 3g/kg seed (T_3), polykote @ 3 ml/kg + neem oil @ 10ml/kg seed (T_4) and in combination of polykote @ 3 ml/kg + insecticide (carbaryl) @ 3g/kg seed + neem oil @ 10ml/kg seed (T_5), one uncoated set of seed was kept as control (T_0). The seeds were shade dried after coating and sown in field using Factorial Randomized Black Design in 3 replications with applying recommended doses of NPK (120:60:40). Results obtained revealed that wheat seed coating with polykote @ 3 ml/kg seed + insecticide (carbaryl) @ 3g/kg seed (T_3), + neem oil @ 10ml/kg seed significantly increased the seed quality parameters, growth, total dry matter production, yield attributes and finally the yield of wheat over uncoated control. Moreover, polymer (polykote @ 3 ml/kg seed) coating in combination of insecticide carbaryl @ 3g/kg seed or neem oil @ 10ml/kg seed separately also showed at par results compared to the combination of polykote @ 3 ml/kg + *Trichoderma viride* (@3 g./kg seed) which showed non-significant results on above parameters.

Key Words : Polymer, Seed coating, *Trichoderma viride*, Neem oil, Carbaryl

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INTRODUCTION

Wheat (*Triticum* spp.) is the worldwide cultivated food crop and provides about one-half of humans' food calories and a large part of their nutrient requirements. India is second largest producer of wheat next to the China. The gradual increase in population demands a substantial increase in its productivity.

Wheat crops are damaged by numerous diseases which cause quantitative as well as qualitative yield losses. The complex of soil and seed borne diseases are frequent in winter wheat, as a result of a combination of unfavorable thermal or humidity factors during sowing and emergence of seed, high grain infection is major problem caused by particularly harmful pathogens when using untreated or inadequate treated seed (Nagy and Moldovan, 2001; 2006).

Seed health is an important attribute of quality, and seed used for planting should be free from pests. Seed infection may lead to low germination, reduced field establishment; several yield loss or a total crop failure. Chemical seed treatment is one of the efficient and economic plant protection practices and can be used to control both external and internal seed infection. It protects young seedlings or adult plants against attack from seed-borne, soil-borne or airborne pests.

It disinfects seed from pathogen, checks spread of

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harmful organisms, promotes seedling establishment, maintains and improves seed quality or minimizes yield losses.

Apart from disease control, seed treatment also has a positive effect on crop growth and yield. Ahmed (1996) reported that wheat seed treatment with systemic fungicides, such as baytan, raxil and vitavax, significantly increased crop stand, grain yield and yield attributes. Meisner *et al*. (1994) reported a 10 per cent increase in wheat yield due to seed treatment with vitavax 200 against smuts.

Seed enhancement may be defined as post-harvest seed treatments that improve germination or seedling growth, or facilitate the delivery of seeds and other materials required at the time of sowing. Seed coating involves application of required materials to the seed-soil interface and the method allows using minor amounts of materials to affect micro environment of each seed.

The positive and significant response of polymer seed coating alone or in combination with insecticide/fungicide/ bio-agents/natural fillers on germination, seedling vigour, growth and yield improvement have been reported by several workers (Rana *et al.*, 2001; Sharin Susan Jhon, 2003; Baxter and Waters, 1986 and Ramya, 2003) in Indian mustard, maize, corn and cowpea crops but the information on wheat crop in relation to response of polymer seed coating along with insecticide and bio-agents on seed quality parameters, growth and yield is still scanty. Therefore, the present investigation was under taken with the following objectives :

- To study the response of polymer seed coating along with bio-agents, insecticides and natural fillers on seed quality parameters, growth and yield of wheat,
- To explore the possibilities of applying insecticides /bio-agent and the natural fillers through seed coating in order to protect the crop for good yield and to minimize the cost of cultivation.

MATERIAL AND METHODS

A field experiment was conducted in two consecutive years (2008-09 to 2010-11) during *Rabi* season at the Research Farm of Directorate of Seed Research, Kushmaur, Mau, U.P., India. The seed material of two wheat genotype *i.e.* HUW-234 (V_1) and HD-2824 (V_2) were obtained from Seed Production and Processing Unit of Directorate of Seed Research and were initially surface sterilized with 0.2 per cent $HgCl_2$. The sterilized seeds were then coated with various combinations of treatments *viz.*, polykote @ 3 ml/kg seed alone (T_1), polykote @ 3 ml/kg seed + *Trichoderma viride* @ 3 g./kg seed (T_2), polykote @ 3 ml/kg seed + carbaryl @ 3g/kg seed (T_3), polykote @ 3 ml/kg seed + neem oil @ 10ml/kg seed (T_4), polykote @ 3 ml/kg seed + carbaryl @ 3g/kg seed + neem oil @ 10ml/kg seed (T_5) and one untreated set of seed lots was kept as control (T_0). The seeds were shade dried after coating and sown in field using Factorial Randomized Black Design in 3 replications and recommended doses of NPK (120:60:40) were applied. In the laboratory, observations on seed quality parameters including germination, seedling dry weight and vigour index were recorded as per the ISTA rules (Anonymous, 1999) and by suggested method of Abdul-baki and Anderson (1973). Field trial was carried out to verify further efficacy of the treatment and for studying the effect of treatment on growth parameters and yield attributes. Number of tillers counted manually very carefully. At the harvesting total biological yield, test weight and grain yield were observed. The experimental data were pooled and statistically analyzed by following the method of Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Seed coating with polykote (Polymer) alone and/or in combination of *Trichoderma viride* has non-significant response on improvement of seed quality parameters including germination, seedling dry weight and finally vigour index (G × SDW) in both the varieties evaluated over uncoated control, but when the wheat seeds were coated with combination of polykote + insecticide carbaryl or polykote + neem oil separately displayed significantly higher germination, seedling dry weight and vigour index over uncoated control and polykote alone. The response of combination of polykote + insecticide + neem oil further showed enhancive effect in all the seed quality parameters but not significantly higher over polykote + insecticide and polykote + neem oil indicating thereby the role of insecticide and neem oil used in combination or singly with polykote which is chemically inert adhesive material (Table 1). Variety HUW-234 showed significantly higher mean germination (85.90%) over HD-2824 (82.30%) but in case of seedling dry weight and vigour index, significantly higher values were recorded in HD- 2824 over HUW-234. Interactions of varieties and treatments were also significant both in germination and seedling dry weight. The per cent of improvement in germination and vigour index due to treatments are depicted in Fig. 1 and 2 and showed that there was enhancement of 16-18 per cent in germination and 30-35 per cent in seed vigour over uncoated control.

These results are very similar with the findings of Rana *et al.* (2001), Sharin and John (2003), Baxter and Waters (1986), Ramya (2003) and Manjunatha *et al.* (2008) in Indian mustard, maize, corn, cowpea and chilli crops because seed coating bring qualitative improvement in the seed, particularly

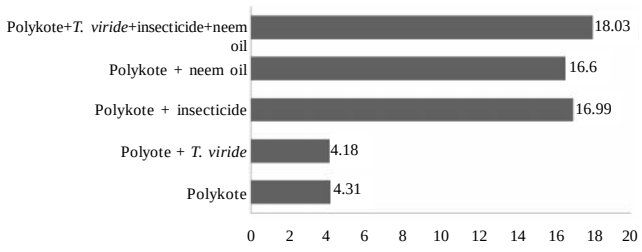

Fig. 1 : Per cent increase in seed germination

Table 1 : Effects of seed coating on seed quality parameters in wheat

Treatments	Germination %			Seedling dry weight (mg.)			Vigour index (G% × SDW)		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_0-Control	78.0	75.0	76.5	409	487	448	31902.0	36525.0	34213.5
T_1-Polykote	81.4	78.2	79.8	401	476	438	32641.4	37223.2	34932.3
T_2-Polyk. + *T. viride*	81.0	78.4	79.7	407	495	451	32967.0	38808.0	35887.5
T_3-Polyk. + Insecticide	91.8	87.2	89.5	462	535	498	42411.6	46652.0	44531.8
T_4-Polyk. + Neem oil	91.4	87.0	89.2	452	532	492	41312.8	46284.0	43798.4
T_5-Polykote + insecticide + Neem oil	92.2	88.4	90.3	472	559	515	43518.4	49415.6	46467.0
Mean	85.9	82.3		434	514		37458.87	42484.63	
S.E. ±	V=1.41, T=3.10			V=35.35, T=18.06			–		
	V×T=4.04			V×T=47.88					
C.D.	V=2.92, T=6.42			V=74.60, T=38.10			–		
	V×T=8.37			V×T=101.04					

Table 2 : Effects of seed coating on growth parameters in wheat

Treatments	Plant height (cm)			No. of tillers/r.m.			Total dry matter kg/plot		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_0-Control	66.8	68.6	67.70	82.1	86.0	84.05	17.40	18.20	17.80
T_1-Polykote	67.2	69.2	68.20	82.0	85.8	83.90	17.80	18.90	18.35
T_2-Polyk. + *T. viride*	67.7	68.1	67.90	82.6	86.70	84.65	18.20	18.80	18.50
T_3-Polyk. + Insecticide	68.0	70.3	69.15	88.3	96.40	92.35	19.80	21.50	20.65
T_4-Polyk. + Neem oil	67.4	68.2	67.80	90.0	95.20	92.60	20.50	21.20	20.85
T_5-Polykote + insecticide + Neem oil	68.4	72.1	70.25	91.2	96.60	93.90	20.80	22.74	21.77
Mean	67.58	69.41		86.03	91.11		19.08	20.22	
S.E. ±	V=0.80, T=1.31,			V=2.21, T=3.62			V=0.53, T=1.03		
	VxT=1.90			VxT=5.22			VxT=1.40		
C.D.	V=1.66 T=NS			V=4.66, T=7.68			V=1.10, T=2.14		
	VxT=NS			VxT=NS			VxT=2.90		

NS=Non-significant

Table 3 : Effects of seed coating on yield attributes and yield in wheat

Treatments	No. of grains / spike			Test weight (g)			Grain yield (kg)/plot		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_0-Control	43.60	46.20	44.90	36.66	37.33	36.99	7.20	8.10	7.65
T_1-Polykote	43.80	46.50	45.15	37.0	38.66	37.83	7.60	8.70	8.15
T_2-Polyk.+ *T. viride*	45.53	45.70	45.61	36.66	39.33	37.99	8.24	9.50	8.87
T_3-Polyk.+ Insecticide	48.50	52.43	50.46	38.20	40.66	39.43	8.70	9.62	9.16
T_4-Polyk.+ Neem oil	47.80	52.20	50.00	39.0	40.00	39.50	8.64	9.50	9.07
T_5-Polykote + insecticide + Neem oil	48.80	54.40	51.60	40.0	41.33	40.66	9.00	10.32	9.66
Mean	46.33	49.57		37.92	39.55		8.23	9.29	
S.E. ±	V=1.33, T=2.30			V=0.74, T=1.10			V=0.45, T=0.66		
	V×T=3.25			V×T=1.65			V×T=0.99		
C.D.	V=2.82, T=4.74			V=1.58, T=2.32			V=0.94, T=1.36		
	V×T=6.77			V×T=3.50			V×T=2.06		

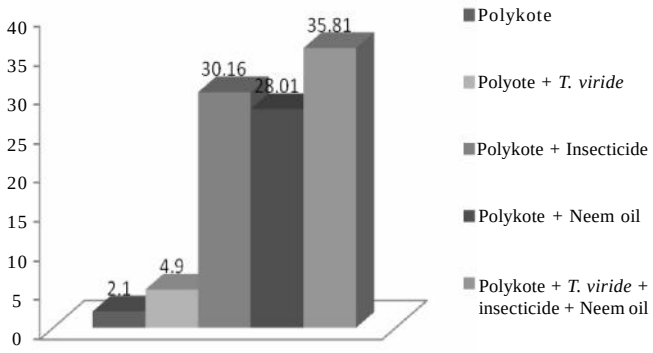

Fig. 2 : Per cent increase in vigour

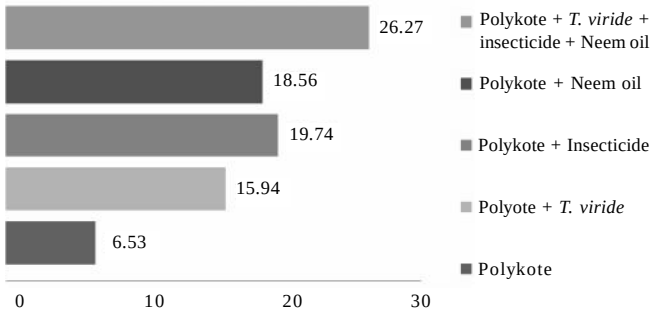

Fig. 3 : Per cent increase in seed yield

germinability, greater storability and better field performance than the corresponding untreated control and it provides protection also from the stress imposed by accelerated ageing, which include fungal invasion.

In growth attributes, plant height was not affected by these treatments and interaction effect of V×T was also insignificant. Mean of varieties showed significantly higher plant height in variety HD-2824 over HUW-234. Number of tillers/r.m. and total dry matter production/plot was significantly improved by seed coating in combination of polykote + insecticide, polykote + neem oil and polykote + insecticide + neem oil but the differences among these treatments were insignificant and indicates that seed coating with insecticide or neem oil along with polykote had the beneficial effects but use of polykote alone or polykote + *T. Viride* had no any beneficial effects on these growth parameters. Variety HD-2824 had significantly higher number of tillers and total dry matter production over HUW-234. Interaction effects of variety and treatments were only significant in case of total dry matter production and maximum dry matter was recorded in HD-2824 with combination of polykote + insecticide + neem oil (Table 2).

Yield components including number of grain/spike, test weight and grain yield were also not affected by seed coating with polykote alone or polykote + *T. viride* but seed coating with polykote + insecticide or polykote + neem oil significantly enhanced these yield attributes over uncoated control and polykote alone. Seed coating with combination of polykote + insecticide + neem oil was found further enhancive for these yield parameters but the differences among combinations of polykote + insecticide or polykote + neem oil or polykote + insecticide + neem oil were statistically at par (Table 3). Improvement in grain yield through these treatments are graphically presented in Fig. 3. The above results clearly indicates that seed coating with insecticide or neem oil along with polykote separately had the significant effects on improvement of seed quality parameters, growth characters and finally on yield attributes and yield in wheat varieties. Use of polykote alone or polykote + *T.viride* had no significant role on these parameters.

The positive and significant response of polymer seed coating alone or in combination with insecticide/ /bio-agents/ natural fillers on germination, seedling vigour, growth and yield improvement have been reported by several workers (Sunderesh *et al.*, 1987; Hwang and Sung, 1991; Gupta and Aneja, 2000; Rana *et al.*, 2001; Baxter and Waters, 1986 and Ramya, 2003) in soybean, Indian mustard, sweet corn, tomato crops and present results supported with their findings but in the present study the responses of coating with polykote alone and polykote + *T. viride* were very meagre and not significant in any characters studied.

Conclusion :

From the present investigation, it can be concluded that seeds of wheat coated with insecticide carbaryl, neem oil and *T. viride* along with polykote significantly enhanced the seed quality parameters, growth and yield attributes. Variety HUW-234 showed significantly higher germination over HD-2824, whereas the values of seedling dry weight, vigour, growth attributes and ultimately grain yield were recorded significantly higher in HD-2824 over HUW-234.

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