# EFFICACY OF SEED-DRESSING FUNGICIDES ON GERMINATION AND GRAIN YIELD OF WHEAT *(TRITICUM AESTIVUM)*

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The test fungicides significantly enhanced the germination and grain yield of wheat cultivars. Highly significant differences were obtained between years, cultivars and fungicidal treatments. Fertex and Granosan-M proved good in enhancing the germination and grain yield, giving statistically similar results. Generally, gemination correlated with yield, the increase in germination gave significantly higher yield. Vitavax enhanced the germination and lowered the yield whereas Granosan-M gave the vice versa results.

## INTRODUCTION

Seed dressing fungicides have received a considerable attention for the last two decades and have proved inexpensive. The technique is also relatively simple method of controlling many seedborne pathogens like *Septoria nodorum* (Verma, 1983), *Puccinia graminis tritici* (Rakotondradon and Line, 1984), *P. recondita* and *P. striiformis* (Rakotondradon and Line, 1984), *Ustilago tritici* and *Urocystis agroperion* (Kausar, 1955), *Tilletia* spp. (Iren *et al.*, 1982), *Mycosphaerella graminicola* (Brown, 1984), *Fusarium gramiearum* (Diehl and Reis, 1983) and protects germinating seeds and seedlings against most of soil borne pathogens.

However, the importance of seed treatment as a method of controlling plant diseases has not been adequately practised in Pakistan. There was, therefore, need for evaluating seed treatment for eliminating seedborne organisms, preventing seed decay and ultimate yield.

## MATERIALS AND METHODS

The experiment was initiated at Regional Agricultural Research Institute, Bahawalpur during the year 1981-85 using wheat cultivars viz., Lyallpur 73, Chenab 70, Blue Silver and PARI 73. Four treatments i.e. Fertex @ 2.4, Vitavax @ 2.4, Granosan-M @ 0.7 g $kg^{-1}$ and untreated control were tested. Seeds were dressed 24 hours before sowing. The experiment was planted at the end of November every year in split plot design with four replications having a plot size of 13 x 3.6 m and 0.47 kg seed and 12 rows $plot^{-1}$. Seed count $plot^{-1}$ was taken.

Observations in respect of germination percentage were recorded by counting the seedlings one week after the emergence. Grain yield was obtained by harvesting and threshing 8 central rows of each plot. The data were analysed by using the method of Little and Hills (1972), considering the years as main plots (A), treatments subplots (B) and cultivars sub-subplots (C).

**Table 1. Analysis of variance in respect of germination and yield**

| Source variation | df | Mean squares | | LSD | |
|---|---|---|---|---|---|
| | | Germination | Yield | Germination | Yield |
| Years (y) | 3 | 6130.00 | 29.24 | 2.66** | 0.08** |
| Error (a) | 9 | 44.17 | 0.0375 | - | - |
| Treatment (F) | 3 | 1624.19 | 5.19 | 4.58** | 0.82** |
| y x F | 9 | 133.83 | 0.3687 | 9.16NS | 0.3NS |
| Error (b) | 36 | 162.96 | 0.2606 | - | - |
| Cultivars (V) | 3 | 1373.20 | 12.95 | 1.32** | 0.12** |
| y x V | 9 | 312.16 | 1.377 | 2.63** | 0.24** |
| F x V | 9 | 79.85 | 0.366 | 2.63** | 0.26** |
| y x F x V | 27 | 63.34 | 0.210 | 5.26** | 0.47** |
| Error (c) | 144 | 14.43 | 0.116 | - | - |

**Table 2. Zero order interactions (means of 64 observations)**

| Year | | | Cultivar | | | Treatment | | |
|---|---|---|---|---|---|---|---|---|
| Year | Germination | Yield | Cultivar | Germination | Yield | Treatment | Germination | Yield |
| 1981-82 | 72.2 b | 3.8 b | Blue Silver | 66.3 c | 3.0 c | Untreated | 61.5 b | 2.9 c |
| 1982-83 | 63.7 c | 3.0 c | Chenab 70 | 73.4 b | 3.8 a | Fertex | 72.9 a | 3.5 a |
| 1983-84 | 79.4 a* | 3.9 a* | Lyallpur 73 | 75.4 a | 3.6 b | Granosan-M | 69.5 a | 3.6 a |
| 1984-85 | 61.7 c | 2.8 b | PARI 73 | 62.9 d | 2.7 d | Vitavax | 70.4 a | 3.2 b |

*Means followed by same letter(s) do not differ significantly at 5% level of probability in each column.

## RESULTS AND DISCUSSION

Years, cultivars, treatments and year versus cultivars, cultivars versus treatments and year x cultivars x treatments interactions gave significantly different results. Interaction between year and treatments was non-significant in respect of germination and yield (Table 1). The effectiveness of seed dressing fungicides in improving seed germination or seedling emergence and enhanced yield in wheat has also been reported by Verma (1983), Barros *et al.* (1983) and Barros and Salgado (1983).

In the year 1981-82, Fertex gave more germination and grain yield of Blue Silver,

**Table 3. First order interaction (means of 16 observations)**

| Year x Cultivar | | | | Treatment x Cultivar | | | |
|---|---|---|---|---|---|---|---|
| Interaction | | Germination | Yield | Interaction | | Germination | Yield |
| Blue Silver | 1981-82 | 66.7 cf | 3.3 e | Blue Silver | Untreated | 69.6 d | 3.35 cd |
| Chenab 70 | 1981-82 | 79.3 b | 4.48 ab | Blue Silver | Fertex | 73.4 c | 3.68 bc |
| Lyallpur 73 | 1981-82 | 81.5 ab | 4.18 c | Blue Silver | Granosan-M | 71.0 cd | 3.58 b |
| PARI 73 | 1981-82 | 65.1 ef | 3.1 ef | Blue Silver | Vitavax | 73.7 c | 3.45 bc |
| Blue Silver | 1982-83 | 64.4 f | 2.73 g | Chenab 70 | Untreated | 74.8 bc | 3.70 bc |
| Chenab 70 | 1982-83 | 66.9 ef | 3.23 e | Chenab 70 | Fertex | 80.1 a | 3.78 b |
| Lyallpur 73 | 1982-83 | 64.3 f | 3.23 e | Chenab 70 | Granosan-M | 76.8 b | 4.35 a |
| PARI 73 | 1982-83 | 59.3 g | 2.45 h | Chenab 70 | Vitavax | 69.6 d | 3.35 cd |
| Blue Silver | 1983-84 | 75.8 c | 3.78 d | Lyallpur 73 | Untreated | 69.0 d | 3.30 cd |
| Chenab 70 | 1983-84 | 79.8 b | 4.63 a* | Lyallpur 73 | Fertex | 67.8 de | 3.18 d |
| Lyallpur 73 | 1983-84 | 83.6 a* | 4.35 bc | Lyallpur 73 | Granosan-M | 66.0 de | 3.08 d |
| PARI 73 | 1983-84 | 78.6 b | 2.93 fg | Lyallpur 73 | Vitavax | 65.2 e | 3.03 d |
| Blue Silver | 1984-85 | 58.4 g | 3.25 e | PARI 73 | Untreated | 63.8 e | 2.93 de |
| Chenab 70 | 1983-84 | 67.6 e | 2.68 g | PARI 73 | Fertex | 63.0 e | 2.68 e |
| Lyallpur 73 | 1983-84 | 72.3 d | 2.70 g | PARI 73 | Granosan-M | 58.3 f | 2.43 ef |
| PARI 73 | 1983-84 | 48.7 h | 2.35 h | PARI 73 | Vitavax | 55.2 h | 2.30 f |

*Means followed by same letter(s) do not differ significantly at 5% level of probability in each column.

Chenab 70, PARI 73 and more germination but less yield of Lyallpur 73 than Granosan-M. In the year 1982-83, there was more yield with Granosan-M than Fertex; Fertex enhanced the germination and yield of Blue Silver and Lyallpur 73 while less germination and yield of Chenab 70 and less germination but more yield of PARI 73 than Granosan-M. Seed treatment produced more yield and less germination with Granosan-M than that with Fertex. In the year 1983-84, Fertex gave more germination but less yield of Blue Silver and Lyallpur but less germination as well as yield of Chenab 70 and PARI 73 than with Granosan-M. There was more germination as well as yield with Granosan-M than that with Fertex during 1984-85; Vitavax gave more germination but less yield in all the cultivars than that with Fertex and Granosan-M.

Germination correlated with the yield for all the cultivars except PARI 73. Blue Silver, Chenab 70. Lyallpur 73 gave the highest germination as well as yield during

**Table 4. Second order interaction (means of 4 observations)**

| Year x Cultivar | | | | | Treatment x Cultivar | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Interaction | | Germination | Yield | | Interaction | | Germination | Yield |
| Blue Silver | 1981-82 | Untreated | 61.6 pqrstuv | 3.31 mnop | Blue Silver | 1981-82 | Fertex | 69.8 jklmn | 3.4 klmno |
| Blue Silver | 1981-82 | Granosan-M | 67.8 klmno | 3.31 mnop | Blue Silver | 1981-82 | Vitavax | 67.8 klmno | 3.31 mnop |
| Blue Silver | 1982-83 | Untreated | 59.0 rstuvw | 2.3 stuv | Blue Silver | 1982-83 | Fertex | 65.1 mnopqr | 3.0 mnopqr |
| Blue Silver | 1982-83 | Granosan-M | 67.11 mnop | 2.9 opqrst | Blue Silver | 1982-83 | Vitavax | 64.6 nopqr | 2.7 qrstu |
| Blue Silver | 1983-84 | Untreated | 63.5 nopqrst | 3.1 mnopq | Blue Silver | 1983-84 | Fertex | 78.4 efgh | 4.0 fghij |
| Blue Silver | 1983-84 | Granosan-M | 87.8 bc | 4.3 cdefg | Blue Silver | 1983-84 | Vitavax | 73.7 ghijk | 3.7 hijkl |
| Blue Silver | 1984-85 | Untreated | 48.9 z | 2.0 v | Blue Silver | 1984-85 | Fertex | 56.6 uvwx | 2.8 pqrst |
| Blue Silver | 1984-85 | Granosan-M | 55.6 vwxy | 2.2 tuv | Blue Silver | 1984-85 | Vitavax | 72.3 hijkl | 2.0 v |
| Chenab 70 | 1981-82 | Untreated | 70.6 ijklm | 4.1 efghi | Chenab 70 | 1981-82 | Fertex | 85.9 bcd | 4.6 cde |
| Chenab 70 | 1981-82 | Granosan-M | 80.9 def | 5.2 ab | Chenab 70 | 1981-82 | Vitavax | 79.8 efg | 4.0 fghi |
| Chenab 70 | 1982-83 | Untreated | 58.8 stuvw | 3.1 mnopq | Chenab 70 | 1982-83 | Fertex | 74.3 ghij | 2.8 pqrst |
| Chenab 70 | 1982-83 | Granosan-M | 63.7 nopqrst | 3.9 fghijk | Chenab 70 | 1982-83 | Vitavax | 71.0 ijklm | 3.7 hijkl |
| Chenab 70 | 1983-84 | Untreated | 75.8 fghij | 4.1 efghi | Chenab 70 | 1983-84 | Fertex | 86.1 bcd | 4.8 bc |
| Chenab 70 | 1983-84 | Granosan-M | 76.8 efghi | 5.5* a | Chenab 70 | 1983-84 | Vitavax | 80.5 def | 4.1 fghi |
| Chenab 70 | 1984-85 | Untreated | 58.8 stuvw | 2.5 rstuv | Chenab 70 | 1984-85 | Fertex | 74.3 ghij | 2.9 pqrs |
| Chenab 70 | 1984-85 | Grenosan-M | 62.7 opqrstu | 2.8 pqrst | Chenab 70 | 1984-85 | Vitavax | 76.1 fg | 2.5 rstuv |
| Lyallpur 73 | 1981-82 | Untreated | 72.2 hijkl | 3.8 ijkl | Lyallpur 73 | 1981-82 | Fertex | 87.3 bc | 4.3 cdefg |
| Lyallpur 73 | 1981-82 | Granosan-M | 85.9 bcd | 4.4 cdef | Lyallpur 73 | 1981-82 | Vitavax | 80.7 def | 4.2 def |
| Lyallpur | 1982-83 | Untreated | 58.2 tuvwx | 3.0 nopqr | Lyallpur 73 | 1982-83 | Fertex | 65.1 mnopqr | 3.5 jklmn |
| Lyallpur 73 | 1982-83 | Granosan-M | 67.21 mnop | 3.0 nopqr | Lyallpur 73 | 1982-83 | Vitavax | 66.8 lmnopq | 3.4 klmno |
| Lyallpur 73 | 1983-84 | Untreated | 76.9 efghi | 4.0 fghij | Lyallpur 73 | 1983-84 | Fertex | 88.7 bc | 4.4 cdef |
| Lyallpur 73 | 1983-84 | Granosan-M | 89.2 b | 4.7 bcd | Lyallpur 73 | 1983-84 | Vitavax | 79.8 efg | 4.3 cdefg |
| Lyallpur 73 | 1984-85 | Untreated | 53.6 wxyz | 2.6 qrstuv | Lyallpur 73 | 1984-85 | Fertex | 58.1 tuvwx | 2.6 qrstuve |
| Lyallpur 73 | 1984-85 | Granosan-M | 52.3 xyz | 3.0 nopqr | Lyallpur 73 | 1984-85 | Vitavax | 58.3 tuvwx | 2.6 qrstuv |
| PARI 73 | 1981-82 | Untreated | 60.7 qrstuv | 2.5 rstuv | PARI 73 | 1981-82 | Fertex | 67.8 klmno | 3.6 ijklm |
| PARI 73 | 1981-82 | Granosan-M | 65.1 mnopqr | 3.5 jklmn | PARI 73 | 1981-82 | Vitavax | 66.9 mnopq | 2.8 pqrst |
| PARI 73 | 1982-83 | Untreated | 50.1 yz | 2.1 uv | PARI 73 | 1982-83 | Fertex | 66.8 mnopq | 2.9 pqrs |
| PARI 73 | 1982-83 | Granosan-M | 59.2 rstuvw | 2.6 qrstuv | PARI 73 | 1982-83 | Vitavax | 61.3 pqrstuv | 2.2 tuv |
| PARI 73 | 1983-84 | Untreated | 62.9 pqrst | 2.5 rstuv | PARI 73 | 1983-84 | Fertex | 90.9* a | 3.3 mnop |
| PARI 73 | 1983-84 | Granosan-M | 83.0 cde | 3.31 mnop | PARI 73 | 1983-84 | Vitavax | 76.6 efghi | 2.6 qrstuv |
| PARI 73 | 1984-85 | Untreated | 46.9 z | 2.1 uv | PARI 73 | 1984-85 | Fertex | 50.4 yz | 2.5 rstuv |
| PARI 73 | 1984-85 | Granosan-M | 39.4 z | 2.7 qrstu | PARI 73 | 1984-85 | Vitavax | 50.0 yz | 2.1 u |

*Means sharing the same letter(s) in each column do not differ significantly at 5% level of significance.

the year 1983-84 whereas cultivar PARI 73 gave the highest germination in the year 1983-84 and the yield in the year 1981-82 (Table 2). The Fertex gave maximum germination followed by Vitavax, Granosan-M and untreated check whereas Granosan-M gave the highest yield followed by Fertex, Vitavax and untreated check (Table 3).

Thus, Fertex put the equal effect on germination and yield whereas Granosan-M enhanced the yield and Vitavax, though increased the germination but put bad effect on the yield. Cultivar Lyallpur 73 gave maximum germination (83.6%) during the year 1983-84 but was statistically dissimilar to Chenab 70 in the same year but similar during the year 1981-82. The Chenab 70 produced maximum yield (4.63 t $ha^{-1}$) which was statistically dissimilar to that of Lyallpur 73 during the year 1983-84 but similar with that of Chenab 70 for the year 1981-82 (Table 3). Chenab 70 gave maximum germination (80.1%) and yield (4.35 t $ha^{-1}$) with Granosan-M followed by Fertex and Vitavax for the same cultivar. The highest germination (90.9%) was recorded for cultivar PARI 73 with Fertex during the year 1983-84, followed by Lyallpur 73 with Granosan-M during the same year, whereas the higher yields (5.5 t and 5.2 t $ha^{-1}$) were recorded for cultivar Chenab 70 with Granosan-M during the year 1983-84 and 1981-82. Verma (1983) reported that seed treatment reduced the root rot severity in both the test cultivars of spring wheat. In all the 3 years, response was apparent in both the cultivars at all the test locations. Diehl *et al.* (1983) also reported the similar results. Brown (1984) obtained 28-62% reduction of infected plants of wheat with the application of seed-dressing fungicides.

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