

GERMINATION OF PADDY SEED IN RELATION TO OVERDOSAGE OF FUNGICIDES

ABDUL GHAFUOR KAUSAR & M. IQBAL CHOHAN

Seed injury in paddy due to overdosage of nine fungicides was investigated in dry and wet nurseries. The germination of treated and untreated paddy seed of four varieties was lower and seed injury due to overdosage of fungicides was more pronounced in wet than in dry nursery. Nine fungicides investigated comprised three groups. The thirams including Arasan, ESD/HS and ESD/AM were the safest fungicides for paddy, while Granosan M, Granosan NI and I & D were unsafe at rates higher than recommended and reduced germination. The remaining fungicides comprising Agrosan GN, Ceresan and Dieldrex were intermediate in this respect.

INTRODUCTION

Seed dressing fungicides for paddy have been extensively investigated. The results of these studies have been reviewed (Leukel, 1936, 1948; Nawaz and Kausar, 1967). The fungi occurring on paddy seeds and the fungicides to counteract their harmful effect have also been studied in Pakistan (Bajwa and Kausar, 1965, 1969; Nawaz and Kausar, 1967). However, the effect of overdosage of fungicides on the germination of paddy seed, seed injury and their relationship with the amount of overdosage do not appear to have received adequate attention.

The effect of application of certain groups of fungicides at rates higher than recommended on the germination of paddy seed in wet nurseries has recently been reported (Kausar *et al.*, 1970). In general, dressing of paddy seed with fungicides at recommended rates enhanced the germination of seed, but Granosan NI, Granosan M, and I & D caused serious seed injury and reduced germination at four and eight times their recommended rates. However, Dieldrex, Agrosan GN, Ceresan and Arasan did not cause seed injury even at eight times their recommended rate.

In a similar study (Kausar and Chohan, 1971), germination of paddy seed was generally lower and seed injury due to overdosage of fungicides was more pronounced in wet than in dry nursery. Granosan M, Granosan NI and I & D caused pronounced seed injury in dry and wet nurseries, and almost completely eliminated germination at 32 times, whereas Granosan M Granosan NI did so even at 8 and 16 times their recommended rates. Arasan and Spergon were the safest and caused no seed injury even at 32 times their recommended rate in dry nursery, but caused some seed injury in wet nursery at 16 and 32 times the recommended rates. Ceresan, Agrosan GN and Dieldre were intermediate in this respect.

The present study is a continuation of these investigations (Kausar *et al.*, 1970; Kausar and Chohan, 1971) and reports the results of experiments designed to study the effect of application of certain fungicides not studied previously at recommended and higher rates on the germination of paddy seed, in dry and wet nurseries.

MATERIALS AND METHODS

The effect of treating paddy seed of four varieties with nine fungicides at four rates of their application on the germination of seed in dry and wet nurseries was studied in the field at Lyallpur in quadruplicated split plot experiments. Rates of application of the fungicides and the varieties formed the larger main plots and the sub-plots respectively. Within the sub-plots of the varieties, plots of the fungicidal treatments formed the next smaller sub-plots. Each sub-plot consisted of a 4 feet long row of each treatment, one foot apart from the other row, and was planted with 625 paddy seeds of the varieties under trial.

Treatment of the paddy seed with fungicides and an untreated check comprised the treatments. The fungicides included in the test and the recommended rates of their application per 45 lbs. paddy seed were as follows: Granosan M, $\frac{1}{4}$ oz; Granosan NI, $\frac{1}{4}$ oz; Ceresan 2 oz; Agrosan GN, 2 oz; Arasan, $1\frac{1}{2}$ oz; ESD/AM, 2 oz, ESD/HS, 2 oz, I & D, 2 oz, and Dieldrex, 2 oz. The first four fungicides are organic mercurials, the next three are thirams and the remaining two are combinations of a fungicide and an insecticide. The fungicides were applied at the recommended, 4, 8 and 16 times their recommended rates. The four varieties of paddy included

in the test were Basmati 370, Jhona 349, Palman 246 and Sathra 278.

The dry nursery comprised paddy seed sown in prepared moist nursery bed which was watered occasionally to keep the soil sufficiently moist. The wet nursery comprised seeding of pre-sprouted paddy seed in puddled nursery bed with a thin sheet of water on the surface, which was kept flooded. The irrigation water was not allowed to stagnate and was replaced by fresh water every morning during the first week and occasionally later on.

The number of paddy seeds germinated was subjected to analysis of variance for the test of significance and interpretation of results.

RESULTS

(a) *Wet Nursery.*

F values for rates of application of fungicides, varieties, and different fungicidal treatments were significant. Similarly, the interaction of fungicides and varieties, fungicides and rates of application were significant. The second order interaction of varieties, rates of application and fungicides was non-significant. Likewise, F value for interaction of rates and varieties was non-significant.

The germination of paddy seed per plot for averages of all the varieties and fungicides for different rates of application of the fungicides (Table I) indicated that application of fungicides at rates higher than recommended decreased the germination of treated paddy seed, particularly at eight or sixteen times the recommended rates. As the interaction of varieties and rates was non-significant, the response of varieties investigated to higher rates of application of fungicides was similar and of the four varieties used in the experiments none was more tolerant to the higher rates of application of the fungicides than the other. However, a significant interaction of fungicides and rates of application indicated that the fungicides applied at rates higher than recommended behaved differently in their deleterious effect on the germination of paddy seed.

Granosan M, Granosan NI and I & D significantly reduced the

germination of paddy seed treated at four, eight and sixteen times the recommended rate. The germination of paddy seed treated with Granosan M, Granosan NI and I & D at sixteen times their recommended rate was poor (Table 2). On the other hand, paddy seed treated with Arasan, and ESD/HS gave significantly higher germination than the untreated seed, even at sixteen times their recommended rate. Paddy seed treated with Arasan, ESD/HS, Ceresan, Agrosan GN and ESD/AM at eight times their recommended rates gave significantly higher germination than the untreated check. Dieldrex enhanced the germination at this rate, but the increase was non-significant statistically. Six of the fungicides other than Granosan M, Granosan NI and I & D enhanced significantly the germination of treated paddy seed at four times their recommended rates. The nine fungicides enhanced the germination of the treated paddy seed at their recommended rates, but the increase was significant in case of Agrosan GN, I& D, Dieldrex, Arasan and Ceresan.

TABLE 1. *Effect of application of fungicides at four different rates on the germination of paddy seed in wet nursery.*

Rate of application	Seeds germinated per plot*	Germination (per cent)
Recommended	379.4	60.7
Four times recommended	322.1	51.5
Eight times recommended	256.1	40.9
Sixteen times recommended	247.2	39.6
L.S.D. at 3 per cent	34.3	5.4
at 1 per cent	45.9	7.3

*On the basis of 625 seeds sown per plot.

TABLE 2. *Germination of paddy seed treated with the fungicides at four rates of application in wet nursery.*

Fungicides	Percent germination of paddy seed treated at four rates				
	Recom- mended	Four times	Eight times	Sixteen times	Average
Granosan M	56.2	40.2	12.3	2.7	27.9
Granosan NI	57.9	16.9	2.2	5.1	20.6
Agrosan GN	64.9	63.0	56.0	49.9	58.4
Ceresan	62.3	59.7	59.4	49.5	57.2
I & D	64.6	48.3	26.2	6.5	36.1
Dieldrex	63.4	63.0	51.0	44.9	50.6
Arasan	63.0	58.8	63.1	63.5	62.1
ESD/AM	60.7	57.2	53.0	47.5	54.6
ESD/HS	60.4	58.6	57.2	62.2	59.3
Check	53.8	49.9	44.5	52.8	50.1

The least significant difference for fungicides as average of all the rates was 3.7 and 4.8 at 5 and 1 per cent respectively.

Of the four varieties of paddy investigated, Basmati 370 gave significantly the highest germination and Palman 246 the least. Jhona-349 gave significantly higher germination than Sathra 278.

The above results showed that out of the fungicides under trial, Arasan, and ESD/HS were the safest fungicides for paddy, while Granosan NI, Granosan M and I & D were generally unsafe at rates higher than recommended and reduced germination.

(b) *Dry Nursery.*

The results in dry nursery were almost similar to those in wet nursery, with the difference that the reduction in germination due to overdosage was generally more marked in the wet nursery than the dry one.

Granosan M and Granosan NI significantly reduced the germination of paddy seed treated at four, eight and sixteen times the recommended rates.

(Table 3). Similarly, I & D reduced the germination of paddy seed at eight and sixteen times the recommended rate. The other fungicides had no similar significant deleterious effect even at these high rates of application. Dieldrex, ESD/HS, Ceresan, Agrosan GN and ESD/AM enhanced the germination of paddy seed at eight times their recommended rates, while Ceresan, Agrosan GN, Arasan and ESD/AM did so at 16 times their recommended rates of application.

TABLE 3. *Germination of paddy seed with nine fungicides at four rates of application in dry nursery.*

Fungicides	Per cent germination of paddy seed treated at four rates				
	Recom- mended	Four times	Eight times	Sixteen times	Average
Granosan M	48.5	35.3	8.1	5.8	24.4
Aranosan NI	45.8	27.2	8.9	5.7	22.4
Agrosan GN	44.5	50.3	51.0	52.7	49.6
Ceresan	45.5	47.2	52.0	53.6	49.8
I & D	45.3	49.3	44.1	23.0	40.1
Dieldrex	43.3	45.0	53.3	48.2	47.5
Arasan	44.1	47.6	48.5	51.8	48.0
ESD/AH	46.6	46.7	50.2	50.4	48.5
ESD/HS	44.0	47.8	52.5	46.7	47.7
Check	46.0	47.5	49.4	49.3	48.0

*The least significant difference for fungicides for all the rates was 3.4 and 4.6 at 5 and 1 per cent levels, respectively.

Thus, seed injury in paddy seed due to overdosage in dry nursery was pronounced with Granosan NI, Granosan M, and I & D at 16 times. The germination of paddy seed treated with Granosan NI and Granosan M at 8 and 16 times was poor. On the other hand, the thirams including Arasan and ESD/AM and the organic mercurials, Agrosan GN and Ceresan were safe, even when used at sixteen times their recommended rate of application.

Taking an average of the fungicides and their rates, Jhona 349 and Palman 246 gave about the same germination, while that of Basmati 370 and Sathra 278 was a little lower than these two varieties. Likewise, the emergence of Sathra 278 was a little lower than that of Basmati 370.

DISCUSSION

Nine fungicides investigated for their effect on germination of paddy seed in the present study comprised three groups. The thiram, Arasan, ESD/HS and ESD/AM were the safest fungicides for paddy, while Granosan M, Granosan NI and I & D were generally unsafe at rates higher than recommended and reduced germination. The remaining fungicides were intermediate in this respect. Seven out of these nine fungicides studied in a previous investigation (Kausar *et al.*, 1970) belonged to two groups. The third group in the present study, as also in a previous investigation (Kausar and Chohan, 1971) has emerged on account of higher rate (16 and 32 times) of application of fungicides used in these studies.

Granosan M, Granosan NI and I & D belonged to the same group in the three investigations. These fungicides caused pronounced seed injury and almost completely eliminated germination at 16 and 32 times, particularly in the wet nursery. Granosan M and Granosan NI did so even at 8 times their recommended rates. I and D was comparatively less deleterious than Granosan M and Granosan NI at 8 and 16 times their recommended rate.

Arasan, Dieldrex, Agrosan GN and Ceresan belonged to the second group in the study of Kausar *et al.* (1970) and did not cause seed injury at eight times their recommended rates. These results have been confirmed in the present study. However, out of these fungicides, only Arasan did not cause seed injury at 32 times in the dry nursery, whereas other fungicides reduced the germination of paddy seed significantly at 16 and 32 times the recommended rates in dry and wet nurseries (Kausar and Chohan, 1971). In the present study, thiram, Arasan, ESD/HS and ESD/AM did not cause significant reduction in germination at 16 times recommended rate. The germination of seed of four paddy varieties used in this study was lower in the wet nursery than in the dry nursery and reduction in germination due to overdosage was more pronounced in wet than in the dry nursery. Even the thiram which proved to be the safest of the fungicides investigated caused some injury in the wet nursery at 16 times in the present study and at 32 times their recommended rates (Kausar and Chohan, 1971).

As indicated previously (Kausar and Chohan, 1971), the plumule of the presprouted seed planted in wet nurseries is fragile and apparently finds more difficulty in establishing itself than the seed planted as such in dry nurseries. It also appears to be more susceptible to higher rates of fungicides. More

precaution is therefore necessary in the selection of a safer fungicide, and in the thorough application of the fungicide selected, at its correct rate of application, for sowings in wet nursery than in the dry nursery.

LITERATURE CITED

- Bajwa, M. N., and A. G. Kausar. 1965. Fungi occurring on paddy seeds and their control. Pak. Jour. Agr. Sci. 2 : 7-20.
- Bajwa, M. N., and A. G. Kausar. 1969. Fungi occurring on paddy seed in the Punjab. Pak. Jour. Agr. Sci. 6 : 125-132.
- Kausar, A. G., and M. I. Chohan. 1971. Seed injury in paddy due to overdosage of fungicides. Pak. Jour. Agr. Sci. 8 : 36-42.
- Kausar, A. G., M. I. Chohan, M. Hussain and Q. U. Ansari. 1970. Trial of seed dressing fungicides for paddy in wet nurseries. Pak. Jour. Agr. Sci. 7 : 101-107.
- Leukel, R. W. 1936. The present status of seed treatment with special reference to cereals. Bot. Rev. 2 : 598-527.
- Leukel, R. W. 1948. Recent developments in seed treatment. Bot. Rev. 14 : 235-269.
- Nawaz, S. M., and A. G. Kausar, 1967. Seed dressing and spray fungicides for the control of paddy blight. Pak. Jour. Agr. Sci. 4 : 324-333.