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INTEGRATED CONTROL OF RICE BLAST DISEASE

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ABSTRACT

Rice blast caused by *Pyricularia oryza*, is one of the most important fungal diseases on rice crop in the world. *Pyricularia oryza, Helminthosporium oryza, Alternaria alternata, stemphylium* sp. and *Aspergillus* sp. were isolated from leaves and panicles from the two tested cultivars (Giza 171 cv. and Sakha 101cv.) during the two tested seasons (2004 and 2005). These fungi were isolated most frequently from Giza 171cv. compared with Sakha101cv.

Laboratory tests were performed to examine the sensitivity of *P. oryza* to Four compounds at different concentrations. The results obtained from *in vitro* tests indicated that, *P. oryza* was differ in sensitivity to the tested compounds. Fuji-one was the most toxic to mycelial growth of the fungus (EC_{50} = 10.0 uga.i/ml), followed by Hinosan (EC_{50} = 21.0 uga.i /ml), followed by Beam (EC_{50} = 30.8 uga.i/ml) and the Neemix (EC_{50} = 63.0 uga.i/ml). Field experiments were conducted to evaluate of five treatments for control rice blast disease during two tested seasons under natural conditions. The results indicated that all the tested compounds reduced infection and severity on leaves and panicles in two tested cultivars (Sakha 101cv. and Giza 171cv.) compared with the untreated control. Also, these treatments increased grain and straw yield of rice crop. The best results was obtained by Beam treatments, Fuji-one, Hinosan, respectively. The Plant-Guard treatment was the least effective, while Neemix gave an intermediate effect.

INTRODUCTION

Rice *(Oryza Sativa* L.*)* is one of the most important cereal food crops in the world *(Bryan et al. 2003)*. It was considered one of the major staple food for millions of people in Asia *(Luna et al. 2002)* and in Egypt *(Abdel-Monem et al. 1995* and *El-Hissewy* and *Badawy, 2002)*. Also, considered a second major export agricultural commodity in Egypt *[El-Kholy* and *Omar, 2004, El-Sheref et al. 2004]*. Rice area annually ranged between 1.0 to 1.5 million fed. which is about 20 to 32.1% of the Egypt total cultivated area during summer season *(Mohamed 2002* and *El-Sheref et al. 2004)*. A bout one million feddan are planted with short duration rice cultivars (4.5 months). From this area, about 79% is planted by transplanting method *(El-Wehishy, 2004)*. Total rice production anually in Egypt was ranged between 5.55 to 6.00 million tons (with anational average of 9.80 ton/ha) which was sufficient for local consumption and export *(Aidy, 2000, El-Hissewy* and *Badawy, 2002* and *Ministry of Agriculture* and *Land Reclamation, 2004)*.

Rice is liable to infect with large number of pests. Among these pests, the rice blast disease, caused by *Pyricularia oryza* Cavara. *[P. grisea* Sacc.; (Telemorph: *Magnaporthe grisea* (Hebert) Barr], is a major constraint on rice production *(Ou, 1972, Kobayashi et al. 2001)*. This disease occurs in rice under various types of cultivation throughout the world *(Silva et al. 2003)*. In Egypt, is considered the most serious and destructive disease of rice causing great losses *(Ashour et al. 1976a, Kamel et al. 1987, Abdel-Monem et al. 1995* and *Sehly et al. 2002)*. The blast pathosystem has two major subsystem, the leaf blast and the panicle blast. During the early growth stages of the host, lesions are mainly formed on leaves, whereas after heading, the pathogen infects the panicles. Panicle blast causes direct yield losses, because grain filling is retard. The inoculum leading to panicle blast results from the spores formed on the leaf blast lesions (*Kobayashi et al. 2001). The* fungus produce lesions on leaves of rice plants throughout the growing season and attack the panicle of maturing plants *(Kim et al. 1988* and *Pandy, 1997).* It caused blast on leaves, leafnode, stem node, neck, rachis and grains *(Thurston, 1984, Bonman et al. 1989, Bonman, 1992,* and *Morinaka* and *Nasser, 1994)*, and causes great losses for the yield *(Kamel et al. 1987, Roumen et al. 1992, Bastiaans et al. 1994*, Kejian *et al.* 1999, and Prabhu *et al.* 2003). Also, is capable to infect weeds such as *cyndon dactylon, Echinochola cruss-galli, E. colonum, Phragmites communis, Phalaris canriences* and *setaria gluca*, and it was also capable of infecting barely, corn, sweet sorghum, sugarcane and wheat *(Ashour et al. 1976b* and *Pandy, 1997).*

Previous investigations show that rice blast diseased can be managed by planting blast-resistant cultivars, avoiding excessive inputs of nitrogen, maintaining high level of soil moisture, changing planting date and using fungicides (*Bonman et al. 1989, Kurschner et al. 1992* and *McLean 1997,* and *Mosa, 2002*), application of chemical fungicides at different growth stages *(Singh et al. 1991, Horino, 1992, Ishiguro et al. 1992, Singh* and *Dodan, 1994, Saifulla et al. 1998, Srivastava, 1999, Santos et al. 2000, Kobayashi et al. 2001, Prabhu et al. 2003* and *Seebold et al. 2004)*, use of bioagents (*Nagariju et al. 2002* and *Ngueko et al. 2002*), plant extracts from *A. indica* (*Mishra and Twari, 1990, Amadioha, 2000* and *Kamalakannan et al. 2001*), and by commercial plant – derived products with or without azadirachtin (*Rajappan et al. 2001* and *Muralidharan et al. 2003*).

Great success for control rice blast disease may be achieved by Integrated systems utilizing the planting of resistant cultivars, cultural practices, and biological and chemical measures. The objective of the present investigation aims are studying the interactions among all these components.

MATERIALS AND METHODS

Laboratory tests were performed in Plant Protection Department and Agricultural Botany Department (Branch of Plant Pathology) Laboratories during this study. Field experiments were conducted in Itay El-Baroud district, Behairah Gov. in summer of two successive seasons (2004 and 2005).

A) Isolation and identification of the causal organisms from leaves and panicles:

Samples of two rice plants [Giza 177 cv. and Sakha 101cv.] from leaf and/or panicle were collected from field experiment. Then, washed with tap water and dried. The leaves or panciles were cut into small pieces (1cm), the pieces were surface sterilized in 1% sodium hypochlorite for 2min, then in 1% ethanol for 3min and washed with sterilized distilled water three times. The small pieces were dried between two sterilized filter papers, then, were place on PDA medium (with streptomycin sulfate at 130ug/ml, *(Yang et al., 1994)*, in Petri dishes (9.0cm) and incubated at 25$\pm$2°C for 3-5 days.

The number of each fungus isolates was counted, and the frequency % of each fungus was calculated as the number of isolates of each fungus divided by the total number of isolates of all fungi from each plant part *(Rossi et al. 1994)*. The identified fungi from rice cultivars are shown in Table (3).

B) Sensitivity of *P.oryza* to the tested compounds under laboratory conditions:

The *in vitro* tests was conducted to examine the sensitivity of *P.oryza* to the three fungicides and one commercial plant – drived compound. The concentrations tested were 0.0, 0.1, 0.5, 1.0, 5.0, 10.0, 100.0, 250, 500 and 1000 ppm (ug a.i/ml) medium. The concentrations were obtained by adding the appropriate amounts of stock suspensions or emulsions to 100 ml portions of autoclaved PDA cooled to about 50°C. The compound amended and unamended PDA were poured into three replicates (Petri dishes, 9cm in diam.). Discs of mycelium (5mm) in diameter) were cut from the 7 day old

culture of *p.oryza*, and invested in the center of compound and – amended and unamended PDA plate. All Petri dishes were incubated at 25±2°C. The fungal growth was measured as mean diameter of colony after 7 days from inoculation by which time the untreated controls for just covered the plate. Percentage of growth inhibition was calculated according to *Toppss* and *Wain* equation *(1957)* as follow:

$$I\,\% = \frac{A - B}{A} \times 100$$

Where:

I % = percent of inhibition.
A = mean diameter growth in the control.
B = mean diameter growth in a given treatment.

Linear regression equations were fitted to logarithmic – probability data of compound concentration and percentage growth inhibition for each compound – fungus – treatment so that slope values and EC_{50} values (concentration giving 50% linear growth inhibition) could be interpolated *(Finney, 1971)*.

C) Field experiments:

The field experiments were conducted to evaluate the integrated methods for controlling rice blast disease in the field, during the two tested seasons. The experiments were designed as a complete randomized block design with three replicates for each treatment. The size of each plot was $21m^2$ (1/200 feedan), 3X7 m.long, with 50cm distance among these plots. Soil samples were taken from the experimental sites from the top of 0-30cm. The physical and chemical characteristics of soils are presented in table (1).

Rice seeds of the two tested cultivars [Giza, 177cv. and Sakha 101cv.] were chosen in this study. Seeds at the rate of 60kg/feddan from each cultivar were soaked in fresh water for 24h. and incubated for 48h., the peregrinated seeds were broadcast by hand in nursery at 10 and 12 May in the 2004 and 2005, respectively. After one month, the plants were transplanted at spacing 15x20cm between rows and hills, after the establishment plants, the plots were banded on all sides.

Potassium and Calcium fertilizers were added after five days from transplanting as Potassium Sulphate (50%) and Calcium Super Sulphate

(15%) at the rate of 50 and 100 kg/feddan, respectively. Nitrogen fertilizer was added at the rate, of 40 kg/feddan as ammonium sulphate (20.6%) in three equal dosses, i.e. 1/3 incorporated in soil, 1/3 at 25 days after transplanting (DAT) and 1/3 at 50 DAT. (*Omar et al., 1991*). Other agricultural practices were followed as normal.

Three fungicides, one bioagent and one commercial product were sprayed at two rates (table 2) in two times i.e. the first at 35 DAT, for control leaf blast, and the second at 1% panicles emergence, for control panicle blast. The characteristics of these treatments are shown in table (2). The experiments were performed under natural condition. Rice plants were evaluated for desease incidence at two times. The first at booting stage (60 DAT), for leaf blast, while the second at 20 days after heading, for panicle blast (*Korium, 1977*). The leaf infection grades were estimated according to the following numerical scale.

Numerical value	Leaf infection grade
0.0	No lesion
1.0	1-2 lesion
2.0	3-5 lesion
3.0	More than 5 lesions but less than 1/4 of the leaf area is destructed
4.0	Forth but less than half of the leaf area is destructed
5.0	half but less than 3/4 of the leaf is destructed
6.0	3/4 or more of the leaf is destructed

Infection grades in the panciles were determined, using the following numerical scale used by *Townsend* and *Heuberger (1943)*, and *Sayed (1986)* as follow:

Numerical value	Panciles infection grade
0.0	No infection
1.0	One infected spikelet / panicle
2.0	Two infected spikelet / panicle
3.0	Three infected spikelet / panicle
4.0	Four infected spikelet / panicle
5.0	Five infected spikelet / panicle
6.0	Six infected spikelet / panicle
7.0	Seven infected spikelet / panicle
8.0	Eight infected spikelet / panicle
9.0	Nine infected spikelet / panicle
10.0	Complete or more than nine infected spikelet/panicle

One hundered and fivty of leaves and/or panicles were collected randomally from each plot and the number of infected leaves and/or panicles were counted to calculated the infection percentages.

The severity of leaf and/or panicle infection was calculated using the following equation descriped by *Townsend* and *Heuberger (1943)*:

$$S = \frac{Sum\ (n\ X\ v)}{10\ X\ N} x\ 100$$

Where:

S = Severity of infection
n = number of leaves or panicles within infection grade
v = numerical value of each grade.
10 = constant, highest numerical value.
N = total number of examined samples.

Table (1): Some Physical and chemical properties of the investigated soil (from Itay El-Baroud district) in the two tested seasons

Season	pH	Organic Matter	T.S.S.* %	Total $CaCO_3$ %	E.C.** m.mohs/ cm	Chemical analysis								Physical analysis			
						Soluble cations meq./L.				Soluble anions meq./L.				Particle size distribution			
						Ca++	Mg++	Na+	K+	CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}	Total clay%	Total sand%	Total silt%	Textural class
2004	7.51	0.75	0.28	1.35	0.75	4.40	1.93	1.73	0.30	0.01	1.53	2.11	4.60	59.12	20.78	20.10	Clay
2005	7.60	0.70	0.31	1.42	0.73	3.95	1.89	1.80	0.36	0.03	1.91	2.19	4.73	61.17	22.13	16.70	Clay

* T.S.S. = Total Soluble Salts.
** E.C. = Electric Conductivity.

Table (2): Trade names, active ingredients or common names, chemical names and rate of applications of the tested compounds

Trade name	Active ingredient or common name	Chemical name [IUPAC]	Rate of Applications / Feddan
Beam 75 W.P.	tricyclazole	5- methyl – 1,2,4 – triazolo [3,4-6] [1,3] benzolthiazale	1- 100 g. 2- 75 g.
Fuji – one 40% E.C.	isoprothilane	di-isopropyl 1-3, di thiolan – 2 – yliden – emalonate.	1-400 cm^3 2-300 cm^3
Hinosan 50% E.C.	edifenphos	O-ethyl – S,S-diphenyl phosphorodithioate	1-200 cm^3 2-150 cm^3
Neemi x 4.5% E.C.	azadirachtin	dimethyl (3S, 3aR, 4S,5S, 5aR, 5a^1 R, 7aS, 8R, 10S, 10aS) – 8-acetoy – 3,3a, 4,5, 5a, 5a^1, 7a, 8, 9, 10-decahydro-3, 5-dih ydroxy 4-{(1S, 3S, 7S, 8R9S, 11R) – 7-hydroxy-9-methyl-2,4, 10-trioxatetracyolo(6.3.1.0$^{3.7}$.0$^{9.11}$] dodec-5-en-11-yl,-4-methyl-10[(*E*)-2-methylbut-2-enoyloxy]-1*H*, 7*H*-naphtho [1,8a,8-bc: 4,4a-c] difuran-3, 7a-dicar boxylate.	1-400 ml 2-300 ml
Plant-Guard 30million spore/cm^3	*Trichoderma Harzianum* L.	Egyptian strains of fungus *T. harzianum* each one cm^3 of the liquid contains 30 million organisms.	1-400 ml 2-300 ml

At harvest, the following results were recorded on plant height (cm), 1000 – grain weight (g.), Grain yield (kg plot^{-1}) rough rice yield were adjusted to reflect a moisture content of 15%, straw yield (kg plot^{-1}) according to *IRRI (1996)*. The results obtained in this study were statistically analyzed according to *Snedecor* and *Cochran (1969)*, and L.S.D. values were performed at *0.01 and 0.05.*

RESULTS AND DISCUSSIONS

A. The isolated fungi:

The isolation was carried out from naturally infected leaves and panicles in two tested cultivars during the two tested seasons (2004 and 2005).

During these years (table 3) five genera were isolated from leaves and panicles. *Pyricularia oryza, Helminthosporium oryza, Alternaria alternata, stemphylium* sp. and *Aspergillas* sp. were isolated. These results also indicated that the frequency and number of isolated fungi differ from year to year and from cultivar to another. Generally, *P.oryza* was the most frequently isolated fungus. Also, the results indicated that the isolated fungi greatly associated with Giza171cv. cultivar compared with Sakha101cv. These results are in agreement with *El-Kazzaz et al. 1990, Eguchi et al., 1995, Benkivane et al. 1998* and *Ahmed, 2003).*

Table (3): The number of isolates and frequency % of the isolated fungi from leaves and panicles during the two tested seasons on two cultivars of rice crop.

Isolated fungi	Giza 171 cv.								Sakha 101 cv.							
	Number of isolates				Frequency %				Number of isolates				Frequency %			
	Leaves		Panicles		Leaves		Panicles		Leaves		Panicles		Leaves		Panicles	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
Pyricularia oryza	49.0	41.0	42.0	35.0	52.69	51.25	57.54	54.69	41.0	36.0	31.0	26.0	51.89	51.43	52.54	50.0
Helminthosporium oryza	23.0	19.0	17.0	13.0	24.73	23.75	23.28	20.31	21.0	21.0	16.0	15.0	26.58	30.0	27.12	28.85
Alternaria alternata	11.0	9.0	9.0	6.0	11.83	11.25	12.33	9.37	9.0	7.0	8.0	8.0	11.39	10.0	13.55	15.38
Stemphylinm sp.	7.0	5.0	5.0	3.0	7.53	6.25	6.85	4.68	6.0	5.0	4.0	3.0	7.59	7.14	6.77	5.77
Aspergillus sp.	3.0	2.0	0.0	0.0	3.23	2.50	0.00	0.00	2.0	1.0	0.0	0.0	2.53	1.43	0.0	0.0
Total	93.0	80.0	73.0	64.0	-	-	-	-	79.0	70.0	59.0	52.0	-	-	-	-

I* = season 2004 II = season 2005**

B. The compounds toxicity *in vitro*:

The *in vitro* toxicity of four compounds (Three fungicides and one plant comercial product) against *P. oryza* was determined. The EC_{50} values of these compounds are indicated in table (4).

The rice blast disease fungus (*P. oryza*) was differ in sensitivity to the tested compounds. Fuji-one showed the highly effective (EC_{50} = 10.0 uga.i/ml) followed by Hinosan (EC_{50}=21.0 uga.i/ml). The neemix showed the least effective (EC_{50}=63.0 uga.i/ml). Beam showed an intermediate effect (EC_{50}=30.8 uga.i/ml). The results obtained from table (4) are in agreement with those obtained by several outhers. *Froyd et. al. (1976)* reported that tricyclazale activity *in vivo* is 25-35% greater than *in vitro*. *Tokousbalides* and *Sisler (1978)* cited that tricyclazole is toxic to growth of *P. oryza in vitro* only at relatively high concentrations. They added that tricyclazole completely blocks melanin biosynthesis at 0.1ug/ml but grow this not inhibited by concentrations as high as 20ug/ml. The antipathogenic activity of tricyclazole

(Beam) parallels the ability of the compound to block the polyketide pathway leading to melanin biosynthesis (*Tokousbalides* and *Sisler, 1978, Woloshuk et. al. 1980, Yamaguchi et. al. 1982*). *Chunyan et. al. (1999)* found that average EC_{50} of tricyclazole to sensitive isolates ranged between 10-50 ppm, while on tolerant isolates was much higher than 50ppm. The average of EC_{50} of tolerant isolates to tricyclazole was approx. 1.25-5 times that of sensitive ones.

On the other hand, *Froyd et. al. (1976)* reported that edifenphos (Hinosan) was very weak fungitoxicity towards *P. oryza* and other fungi *in vitro*. Edifenphos affects the permeability of cell membrane and inhibits chitin synthesis in *P. oryza* and also causes leakage of ^{32}P-phosphate from mycelium *(Waard, 1972). Mustaq, Ahmed (1992)* Found that edifenphos was inhibited the spore germination of *P. oryza in vitro*.

Also, *Amadioho (2000)* cited that neem seed extracts significantly reduced *in vitro* radial growth of *P. oryza*. *Rajappan et. al. (2001)* mentioned that emulsifiable concentrate neem formulations inhibited myceliol growth of *C. myabeanus* and *P. oryza*. similar trend of results were obtained by *Kanalakannan et. al. (2001)*.

Table (4): Sensitivety of *P. oryza* to different compounds at different concentrations (ug a.il/ml) required to inhibit *in vitro* growth of the tested fungus by 50% (EC_{50}) on potato dextrose agar medium

Compounds	Beam	Fuji-one	Hinosan	Neemix
EC_{50}	30.8	10.0	21.0	63.0
Slope	0.83	1.30	0.83	0.73

C- Field experiments:

Evaluation of different treatments under field conditions for the control rice blast disease was conducted during the summer of 2004 and 2005 seasons. Three fungicides (Beam, Fuji – one and Hinosan), one plant-derived material (Neemix) and one bioagent (Plant-Guard) were investigated at two rate of applications for their effect on rice blast disease incidence. The results in tables (5 and 6) showed the effect of the tested materials on number of infected leaves, % of infected leaves and on leaf severity of the two tested cultivars (Giza 171 cv. and Sakha, 101cv.) in the two tested seasons. These results indicated that all the tested materials significantly (*P=0.01* and *0.05*) reduced the number of infected leaves, % of infected leaves and leaf severity than the untreated control. In the case of number of infected leaves, Beam gave the best results followed by Hinosan and Fuji-one. The lowest effect obtained from Plant-Guard treatment. The treatment with Neemix showed an intermediate effect. Also, the higher rate gave the best results than the lowest rate in all tested materials. Percentage of infected leaves was also reduced by any tested materials. Sakha 101cv. was the best than Giza 171cv. in response to the tested materials. However, in the cause of Fuji-one, Sakha 101cv. ≥ Giza 171cv. Only, but other treatments gave the best results on Sakha 101cv. Than on Giza 171cv. The same trend of results was also found in the case of leaf severity, Beam fungicide gave the best results ≥ Hinosan > Fuji-one ≥ Neemix > Plant-Guard in Giza 171cv., while on Sakha 101cv. was Beam ≥ Hinosan ≥ Fuji-one = Neemix > Plant-Guard. Also, the higher rate gave the best results than the lower rate. Sakha 101cv. gave the best results than Giza 171cv. These results were true in the two tested seasons.

These results are in accordance with those obtained by several authors. *Horino (1992)* mentioned that chemical control of rice blast in Egypt is economically worthwhile. *Ishiguro et al. (1992)* reported that edifenphos (Hinosan) or ferimzone and isoprothiolane (Fuji-one) when sprayed on rice plants inhibited lesion enlargement of rice blast lesions and spore formation of *P.oryza*. *Paul* and *Coulombe (1993)* found that tricyclazole (Beam) gave the best results in the field to control *P.oryza*. similar trends of results was obtained by *Saifulla et al. (1998)*, *Srivastara (1999)*, *Ministry of Agriculture* and *Land Reclamation (2004)*.

These results in tables (5,6) showed that Neemix treatment gave the intermediate effect. These results are in agreements with several authers. *Amadioho (2000)* mentioned that water and leaf extracts as well as oil extracts of neemseeds significantly reduced the development and spread of blast disease in rice plants in the greenhouse. *Mualidharam et al. (2003)* found that the plant-derived products with or without azadrachtin reduced disease severity and also increased yield of grains. They suggested that plant-derived products serve as an effective component in integrated management of rice diseases.

Table (5): Effect of different spray treatments on rice blast on leaves of two tested cultivars (season 2004) under field condition

Treatments	Rate of applications/ Feddan	Number of infected leaves		% of infected leaves		Leaf severity	
		Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101
Beam	1- 100g.	13.00	8.66	8.66	5.77	4.20	2.53
	2- 75g.	6.33	4.00	4.22	2.66	2.16	1.61
Fuji-One	1-400 cm^3	18.00	16.33	12.00	10.88	5.34	3.71
	2-300 cm^3	13.67	8.33	9.11	5.55	3.29	1.64
Hinosan	1-200 cm^3	20.00	13.33	13.33	8.89	4.58	3.14
	2-100 cm^3	12.33	6.66	8.22	4.45	2.48	2.06
Neemi x	1-400 ml	25.00	20.00	16.66	13.33	5.22	3.70
	2-300 ml	13.66	11.33	9.11	7.55	3.49	2.18
Plant-Guard	1-400 ml	28.66	23.33	19.11	15.55	7.10	5.95
	2-300 ml	18.33	12.00	12.22	8.00	4.51	3.53
Untreated (Control)	-	43.33	36.00	28.89	24.00	16.83	14.78

L.S.D at	1%	5%	1%	5%
Treatments(T.)=	2.83	2.12	0.68	0.51
Rates (R.)=	1.75	1.31	0.42	0.31
Cultivars (C.)=	1.79	1.34	0.43	0.32
TXR=	N.S.	N.S.	N.S.	N.S.
TXC	N.S.	N.S.	N.S.	N.S.
RXC	N.S.	N.S.	N.S.	N.S.
TXRXC=	N.S.	N.S.	N.S.	N.S.

The results also in table (5 and 6) indicated that bio agent (Plant-Guard) gave the lowest effect in compared with other treatments. Also, significantly reduced leaf infection and leaf severity than control treatment.

Shahjuhan (1997) reported that, in field plots, 14 to 16 fungi significantly reduced blast disease severity and five of them increased yield significantly. These fungi belonged to the genera *Fusarium, Penecillium, Phoma, Rhizoctonia* and *Trichoderma*.

Table (6): Effect of different spray treatments on rice blast on leaves of two tested cultivars (season 2005) under field condition

Treatments	Rate of applications/ Feddan	Number of infected leaves		% of infected leaves		Leafs severity	
		Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101
Beam	1- 100g.	11.00	9.00	7.33	5.99	3.66	2.16
	2- 75g.	6.00	3.33	3.99	2.22	1.47	1.33
Fuji-One	1-400cm3	16.66	16.00	11.11	10.66	4.36	3.29
	2-300 cm3	13.67	8.00	8.66	5.33	2.61	1.50
Hinosan	1-200 cm3	19.00	13.66	12.66	9.11	3.97	2.86
	2-100 cm3	12.66	6.00	8.44	3.99	2.10	1.28
Neemi x	1-400 ml	24.66	18.66	16.44	12.44	496	3.65
	2-300 ml	12.66	10.33	8.44	6.89	2.74	1.62
Plant-Guard	1-400 ml	28.66	21.66	19.11	14.44	6.33	5.53
	2-300 ml	19.00	11.33	12.66	8.22	4.18	3.18
Untreated (Control)	-	41.33	34.03	27.55	22.26	15.12	13.26

L.S.D at	1%	5%	1%	5%
Treatments (T.)=	2.42	1.81	0.65	0.49
Rates (R.)=	1.53	1.15	0.42	0.31
Cultivars (C.)=	1.52	1.14	0.41	0.31
TXR =	N.S.	2.56	N.S.	N.S.
TXC	N.S.	2.58	N.S.	N.S.
RXC	N.S.	N.S.	N.S.	N.S.
TXRXC =	N.S.	N.S.	N.S.	N.S.

The results in tables (7 and 8) showed the effect of the tested materials on number of infected panicles, % of infected panicles and panicle severity in the two tested seasons. The results indicated that all the tested materials significantly reduced the number of infected panicles, % of infected panicles and blast severity of panicles. Beam fungicide gave the best results > Fuji-one ≥ Hinosan > Neemix > Plant-Guard. Also, the higher rate gave the best results than the lowest. Sakha 101cv. was superior to Giza 171cv. in these results. The same trend of results was obtained in the two tested seasons on two tested cultivars. These results are in agreements with many authers. *Singh et al. (1991)* found that, the most effective reducing neck blast and node blast was given with edifenophas and carbendazim. *Singh* and *Dodan (1994)* mentioned that, among 7 fungicides tested against *M.grisea* under field conditions on the susceptible rice cultivars, tricyclazole and propiconazole (both at 1%) were the most effective in reducing neck blast. The same trend of results obtained by *Saifulla et al. (1998)*, *Santos et al. (2000)*, *Prabhu et. al. (2003)* and *Ministry of Agriculture* and *Land Reclamation (2004)*.

Table (7): Effect of different spray treatments on rice blast on paincle of two tested cultivars (season 2004) under field condition

Treatments	Rate of applications/ Feddan	Number of infected panicle		% of infected leaves		Panicle severity	
		Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101
Beam	1- 100g.	10.00	8.33	6.66	5.55	7.75	6.95
	2- 75g.	5.10	4.00	3.34	2.67	2.59	2.28
Fuji-one	1-400 cm^3	12.00	9.33	8.00	6.22	11.30	8.99
	2-300 cm^3	7.00	6.00	4.66	4.00	6.05	3.87
Hinosan	1-200 cm^3	11.00	9.66	7.33	6.44	10.01	7.68
	2-100 cm^3	5.67	5.00	3.78	3.33	3.96	3.03
Neemi x	1-400 ml	13.67	10.66	9.11	7.11	15.34	13.20
	2-300 ml	7.33	7.00	4.89	4.66	8.50	6.78
Plant-Guard	1-400 ml	16.33	14.00	10.89	9.33	17.46	15.33
	2-300 ml	9.00	9.00	6.00	6.00	9.71	7.61
Untreated (Control)	-	42.33	36.66	28.22	24.44	47.40	39.97

L.S.D at	1%	5%	1%	5%
Treatments(T.)=	1.58	1.18	1.10	1.38
Rates (R.) =	1.00	0.75	0.66	0.87
Cultivars (C.)=	1.00	0.74	0.65	0.87
TXR =	N.S.	N.S.	1.45	N.S.
TXC	N.S.	N.S.	N.S.	N.S.
RXC	N.S.	1.67	N.S.	N.S.
TXRXC =	N.S.	N.S.	N.S.	N.S.

Table (8): Effect of different spray treatments on rice blast on panicle of two tested cultivars (season 2005) under field condition

Treatments	Rate of applications/ Feddan	Number of infected panicle		% of infected leaves		Panicle severity	
		Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101
Beam	1- 100g.	9.33	7.00	6.22	4.66	7.31	6.54
	2- 75g.	4.00	3.00	2.66	1.99	2.51	2.10
Fuji-One	1-400cm^3	11.66	8.00	6.88	5.55	10.56	8.18
	2-300 cm^3	5.33	4.33	3.55	2.89	5.62	3.61
Hinosan	1-200 cm^3	10.00	9.00	6.66	5.78	9.33	7.28
	2-100 cm^3	4.66	4.00	3.10	2.66	3.77	2.79
Neemi x	1-400 ml	13.66	9.66	7.77	6.44	14.17	11.89
	2-300 ml	6.33	5.33	4.22	3.55	7.91	5.48
Plant-Guard	1-400 ml	14.66	11.66	9.77	7.78	16.52	13.86
	2-300 ml	8.66	7.33	5.77	4.88	9.13	6.83
Untreated (Control)	-	39.00	32.33	25.99	21.55	42.57	38.10

L.S.D at	1%	5%	1%	5%
Treatments (T.)=	1.56	1.17	1.37	1.02
Rates (R.) =	0.98	0.73	0.88	0.64
Cultivars (C.)=	0.99	0.74	0.87	0.65
TXR =	N.S.	N.S.	N.S.	N.S.
TXC	N.S.	N.S.	N.S.	N.S.
RXC	N.S.	N.S.	N.S.	N.S.
TXRXC =	N.S.	N.S.	N.S.	N.S.

The results in tables (9 and 10) showed the effect of the tested materials an plant hight (cm) grain yield ($Kgplot^{-1}$), straw yield ($kgplot^{-1}$) and weight of 1000-grains. The results clearly indicated that all the tested material significantly increased the plant hight than the untreated control. Beam gave the best results > Hinosan > Fuji-One-Neemix > Plant-Guard. These results is true in two tested cultivars. Also, increased the grain and straw yield ($kgplot^{-1}$) in the same trend. Also, weight of 1000-grains was increased in all treatments in two tested cultivars. These results are in accordance with those obtained by several authers such as *Singh et al. (1991), Singh* and *Dodan (1994) Shahjuhan et al. (1997), Saifulla et. al. (1998), Srivastava (1999), Kanalakannan et al. (2001), Nagaraju et al. (2002),* and *Prabhu et al. (2003).*

Agricultural practices play an important role in blast disease control. These results obtained in tables are in agreement with several investigators. *Omar et al. (1991)* indicated that the best results in reducing blast disease in rice was obtained when 40KgN/fed. were added in three equal doses, i.e. 1/3 incorporated into soil, 1/3 at 25 days after transplanting (DAT) and 1/3 at 50 DAT. Also, when the amounts plitted in two times 1/2 rate at 25 DAT and 1/2 at 50 DAT. However, the application of all N-fertilizer amount; half or two third as abasal dose incorporated into soil, increased both leaf and panicle infections.

The results indicated that rice cultivars differ in susceptibility to blast disease. These results are in agreement with *Prabhu et. al. (2003) Silva et. al. (2003)* and *Ahmed (2003)..*

Also, *Assey et al. (2002)* observed that transplanting method surpassed other one (broodcasting, dibbing and hand drilling) in plant hight, number of tillers/m^2, grain and straw yields/feddan. *El-Sheref et al. (2004)* reported that the highest grain yield was recorded at 15x20 cm, and the lowest at 10x20cm.

The overall results showed that Beam fungicide gave the best results in the field experiments, while this fungicide gave the very weak fungitoxicity in laboratory tests. According to *Froyd et. al. (1976)* tricyclazole (Beam) activity *in vivo* is 25-35% greater than *in vitro*. They added that the lack of correlation between disease control and *in vitro* fungitoxicity indicates that tricyclazole is altered in the plant or that it affects host resistance or pathogenicity of *P. oryza* or the pathogen parasite interaction. *Cartwright et al. (1977)* reported that the action of tricyclazole may be the suppression of pathogenic mechanisms in *P.oryza* or the accentuation of palnt resistance mechanisms in a manner similar to the reported for 2,2- dichloro – 3,3 – dimethylcylopropane carboxylic acid. *Tokoubalides* and *Sisler (1979)* observed that antifungal activity of tricyclazole is indirect and expressed only *in vivo*.

Also, *Vyas (1984)* mentioned that the lack of *in vitro* fungitoxicity indicates that tricyclazole is altered in the plant or that it affects host resistance.

Generally, the tested materials induce a significant reduction in the percentage and severity of infection on both leaves and panicles and consequently increased the grain and straw yields as compared with the untreated control.

Table (9): Effect of different spray treatments on plant hight (cm), Grain yield, strow yield and 1000 grain weight in two cultivars during the tested season 2004 under field conditions.

Treatments	Rate of applications/ Feddan	Plant hight(cm)		Grain yield kg plot^{-1}		Strow yield kg plot^{-1}		Weight of 1000grain(g)	
		Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101
Beam	1- 100g.	126.54	126.14	22.60	23.79	27.70	28.17	26.93	27.04
	2- 75g.	123.80	125.42	21.60	22.06	26.64	27.00	24.30	24.78
Fuji-one	1-400cm3	124.91	125.38	20.27	20.68	26.48	26.58	25.24	25.51
	2-300 cm3	123.29	124.64	19.82	20.21	25.99	26.13	23.48	24.02
Hinosan	1-200 cm3	125.45	125.70	20.65	21.33	27.17	27.30	25.77	26.73
	2-100 cm3	124.41	125.62	20.23	20.31	26.30	26.68	23.93	24.30
Neemi x	1-400 ml	124.31	125.01	20.08	20.75	26.03	26.13	23.93	24.24
	2-300 ml	123.08	123.88	19.22	19.47	25.55	25.76	23.42	23.83
Plant-Guard	1-400 ml	123.87	124.35	20.02	20.15	25.54	26.67	23.29	23.76
	2-300 ml	122.47	122.87	19.57	19.95	25.21	25.17	22.52	23.30
Untreated (Control)	-	120.18	121.38	17.54	18.43	23.52	23.83	22.44	22.64

L.S.D at	1%	5%	1%	5%	1%	5%	1%	5%
Treatments (T.)=	0.78	0.58	0.78	0.58	0.54	0.41	N.S.	1.23
Rates (R.)=	0.50	0.36	0.49	0.36	0.34	0.26	1.04	0.77
Cultivars (C.)=	0.49	0.37	N.S.	0.38	N.S.	N.S.	N.S.	N.S.
TXR =	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
TXC	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
RXC	N.S.	0.52	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
TXRXC =	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table (10): Effect of different spray treatments on plant hight (cm), Grain yield, strow yield and 1000 grain weight in two cultivars during the tested season 2005 under field conditions.

Treatments	Rate of applications/ Feddan	Plant hight(cm)		Grain yield kg plot^{-1}		Strow yield kg polt^{-1}		Weight of 1000grain(g)	
		Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101	Giza171	Sakha101
Beam	1- 100g.	125.87	125.64	23.25	24.33	28.10	28.40	27.58	27.38
	2- 75g.	124.17	125.27	21.82	22.18	26.31	27.23	24.77	25.08
Fuji-one	1-400cm3	124.63	123.72	21.21	20.97	26.65	27.18	25.68	25.67
	2-300 cm3	123.94	123.27	20.55	20.48	26.14	26.57	24.10	23.81
Hinosan	1-200 cm3	124.77	125.11	21.11	21.60	27.14	27.78	25.98	26.21
	2-100 cm3	123.93	124.88	20.86	20.44	26.64	26.93	24.18	24.81
Neemi x	1-400 ml	125.00	125.06	20.48	21.03	26.30	26.48	24.38	24.15
	2-300 ml	123.20	123.60	19.53	19.70	25.83	26.16	23.72	24.02
Plant-Guard	1-400 ml	123.84	124.57	20.59	20.43	26.16	26.06	23.83	24.41
	2-300 ml	123.10	123.20	19.78	20.32	25.77	25.70	23.18	23.74
Untreated (Control)	-	121.57	121.22	18.30	19.21	24.04	24.33	22.64	22.92

L.S.D at	Plant hight 1%	Plant hight 5%	Grain yield 1%	Grain yield 5%	Strow yield 1%	Strow yield 5%	Weight 1%	Weight 5%
Treatments (T.)=	1.11	0.82	0.78	0.58	0.51	0.37	0.79	0.59
Rates (R.)=	0.70	0.52	0.49	0.36	0.31	0.24	0.50	0.37
Cultivars (C.)=	N.S.	N.S.	N.S.	N.S.	0.32	0.23	N.S.	N.S.
TXR =	N.S.	N.S.	N.S.	N.S.	N.S.	0.53	1.13	0.84
TXC	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
RXC	N.S.	1.67	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
TXRXC =	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Also, foliar spraying with chemical fungicides is important mean for controlling foliar disease. Rice blast disease can be controlled by spraying with different fungicides at different growth stages. The use of resistant cultivars and application of fungicides significantly reduced the terminal disease severity and improved the yield of the crop. The best results was obtained with Beam fungicide followed by Fuji-one or Hinosan and the lowest effective was obtained with Plant-Guard. The neemix treatment showed an intermediate effect. Sakha 101cv. was resistance to blast compared with Giza 171cv.

The similar trend of results was obtained by *Srivastava (1999)*. He tested tricyclazole (Beam) carbendazim (Bavistin), iprobenfos (Kitazin), Ziram (Cuman-L), chlorothalonil (Karach), thiophanate-methyl (Topain-M) and edifenphos (Hinosan) for their ability to control rice blast (*P.oryza*). He found that all the fungicides reduced the disease incidence and increased grain yield compared with the untreated control, Tricyclazole was the best fungicide in controlling the disease and increasing yield.

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المكافحة المتكاملة لمرض اللفحة فى الأرز

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يعتبر مرض اللفحة في الأرز (الذى يحدثه فطر بيريكيولاريا أوريزا) من أهم الأمراض الفطرية على الأرز في العالم. وقد تم عزل فطريات بيريكيولاريا أوريزا) هيلمنثوسبوريوم أوريزا، الترناريا الترناتا، إستيمفيليوم والأسبرجلس من أوراق وسنابل صنفى جيزة ١٧١ وسخا ١٠١ خلال موسمى الدراسة ٢٠٠٤ و٢٠٠٥ م. وقد كانت الفطريات المعزولة أكثر تكرارا على صنف جيزة ١٧١ عند المقارنة مع صنف سخا ١٠١.

تم دراسة حساسية فطر بيركيولاريا أوريزا فى المعمل لأربعة مركبات على تركيزات مختلفة، وقد بينت النتائج المعملية أن الفطر تختلف حساسيته للمركبات المختبرة. كان مبيد فوجى وان أكثر المركبات سمية وأنقص نمو مسيليوم الفطر (EC_{50} = 10.0ug/ml) متبوعا بمركب هينوزان (EC_{50} = 21.0ug/ml) ثم مركب بيم (EC_{50} = 30.8ug/ml) ثم مركب نيمكس (EC_{50} = 63.0ug/ml). وتم تقييم خمسة مركبات تحت الظروف الحقلية على صنفين من الأرز لمكافحة مرض اللفحة تحت الظروف الحقلية (صنف سخا ١٠١ وصنف جيزة ١٧١) على مدار موسمين (٢٠٠٤-٢٠٠٥). وقد أوضحت النتائج الحقلية أن كل المركبات تنقص المرض على الأوراق والسنابل بصورة واضحة عند مقارنتها بالغير معامل وكذلك فان هذه المعاملات قد أدت إلى زيادة محصول الحبوب والقش فى الأرز. وقد كانت أحسن النتائج عند استعمال البيم ثم فوجى وان ثم هينوزان على الترتيب. وكانت أقل المركبات المستخدمة فى فاعليتها فى مكافحة المرض هو المركب الحيوى بلانت جارد بينما أعطت المعاملة بمركب النيمكس تأثيرات متوسطة. وكان صنف سخا ١٠١ أحسن من صنف جيزة ١٧١.