Bioefficacy of Strobilurin Based Fungicides against Rice Sheath Blight Disease

Bag MK*, Yadav M and Mukherjee AK
ICAR- National Rice Research Institute, Cuttack, Odisha, India

Abstract

As the usage of fungicides catapulted with the onward march of the dial hour, fungicidal resistance by the pathogens emerged as a new constraint. This amalgamated with the growing demand by the farmers for crop protection agents with low use rates, a benign environmental profile and a low toxicity to human and wild life, further gave an impetus to the search of new molecule of fungicides with novel modes of action. Sheath blight of rice caused by *Rhizoctonia solani Kühn* is one of the devastating diseases in eastern part of India. Various attempts were taken to develop sheath blight resistant variety but till date no such varieties were released. Various cultural practices combined with use of fungicides are the most common option of managing the disease. Repeated use of same fungicides in the same field sometimes become less or not effective, may be due to development of resistance recombiant of *R. solani*. Several experiment proved strobilurin based molecules like azoxystrobin, trifloxystrobin, metominostrobin manage the disease effectively and eco-friendly way than other commercially available fungicides.

Keywords: Disease; Fungicide; Sheath blight; Strobilurin

Introduction

Sheath Blight (ShB) (C.O. *Rhizoctonia solani* Kühn) is one of the most devastating diseases of rice particularly in wet season. The disease has spread in all rice growing areas in large scale and in some areas it is due to widespread cultivation of susceptible variety, as in case of West Bengal and Odisha where ‘Swarna’ (MTU 7029) which is widely cultivated and is highly susceptible to sheath blight pathogen ‘*R. solani*’. Damage is estimated upto 100% in favourable climatic condition and yield loss of rice varies from 5.2-50% depending on disease severity [1-3]. Though cultivation of resistant variety is the best option to cope up the attack of this pathogen but till date no such variety is available to the growers. Thus, in present situation cultural practices combined with foliar spray of fungicide is the most common practice to manage the disease and even in integrated pest management system need based application of fungicide has been recommended. In this context, a long term experiment was conducted to evaluate the efficacy of new generation bio-rational fungicide of ‘strobilurin derivatives’. Strobilurins (also known as β-methoxyacrylates) or Qo1 (Quinone outside Inhibitors) fungicides, launched in 1996 are analogues of strobilurin-A [4] originally derived from natural products [5] (*Strobilurus tenacillus*, a wild mushroom growing in forests). Strobilurins, are now the second largest chemistry group of fungicides, widely used on cereals and, more recently, on soybeans (a market that reached $600 million in 2004). The strobilurin fungicides mainly act on mitochondrial synthsis in *cytochrome b1*, are highly effective, and are suitable for a wide range of crops include Azoxystrobin, Fluoxastrobin, Kresoxim-methyl, Metominostrobin, Picoxystrobin, Pyraclostrobin and Trifloxystrobin (Table 1). The new fungicides were most effective in decreasing disease severity and increasing grain yield in comparison to control (without fungicide). These fungicides were also proved as best or at par with leading triazole compounds to manage the sheath blight disease of rice at several collaborating and volunteer centre under All India Coordinated Rice Improvement Programme (AICRIP) [6,7].

Materials and Methods

Systematic research was initiated since 2002 and followed up to 2010 at experimental farm of Rice Research Station, Chinsurah, West Bengal (22°38'N and 88°39'E) to evaluate various strobilurin and combination of strobilurin fungicide viz. azoxystrobin 25 SC, trifloxystrobin 25%+tebuconazole 50% 75 WG and Metaminostrobin 20 SC. In each experiment, new fungicide, 2-3 commercial fungicides, control (without fungicide) and one best commercial fungicide (check fungicide) were taken as treatments. All the experiments were

<table>
<thead>
<tr>
<th>Name</th>
<th>Chemical name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azoxystrobin</td>
<td>Methyl(E)-2-2-[6-(2-cyanophenox) yrimdin-4-yloxy[phenyl]-3- methoxyacrylate]</td>
<td>Fungicide with protectant, curative, eradicant, translaminar and systemic properties. Inhibits spore germination and mycelial growth, and also shows anti- sporulant activity.</td>
</tr>
<tr>
<td>Fluoxastrobin</td>
<td>E)-2-[6-(2-chlorophenox)-5-fluoropyrimidin-4-yloxy] phenyl (5,6-dihydro-1,4,2- dioxazin-3-yl) methane O-methyloxime</td>
<td>Systemic (and locosystemic) fungicide with protective and curative properties. It is acropetally translocated when sprayed on leaves. Acts as an inhibitor of spore germination and mycelial growth.</td>
</tr>
<tr>
<td>Kresoxim-methyl</td>
<td>Methyl(E)-methoxyimino[2-(o-tolylmethoxy)phenyl] phenyl acetate</td>
<td>Fungicide with protective, curative, eradicative and long residual disease control; acts by inhibiting spore germination. Redistibution via the vapour phase contributes to activity.</td>
</tr>
<tr>
<td>Metominostrobin</td>
<td>(E)-2-methoxyimino-N-methyl-2-(2-phenoxophenyl) acetonide</td>
<td>Systemic fungicide with protective and curative action.</td>
</tr>
<tr>
<td>Picoxystrobin</td>
<td>Methyl(E)-3-methoxy-2-[(2-6-trifluoromethyl-2-pyridylmethoxy)phenyl] acrylate</td>
<td>Preventive and curative fungicide with unique distribution properties including systemic (acropetal) and translaminar movement, diffusion in leaf waxes and molecular redistribution in air.</td>
</tr>
<tr>
<td>Pyraclostrobin</td>
<td>Methyl-N-2-[1-(4-chlorophenoxy)-1H-pyrazol-3-yloxymethyl] phenyl (N-methoxy)carnamate</td>
<td>Fungicide with protectant, curative, and translaminar properties.</td>
</tr>
<tr>
<td>Trifloxystrobin</td>
<td>Methyl(E)-methoxyimino(E)-[1-(o,a,a,-trifluoro-m-tolyl) ethylideniminoxy]toloyl acetate</td>
<td>Mesostemic, broad-spectrum fungicide with preventive and specific curative activity. Displays rain-fastness property. Translocate by superficial vapor movement and also has translaminar activity.</td>
</tr>
</tbody>
</table>

Table 1: Different strobilurin analogues and their use.

*Corresponding author: Bag MK, ICAR-National Rice Research Institute, Cuttack, Odisha-753006, India, Tel: 0671 236 7788; E-mail: manas.bag@gmail.com

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conducted with rice variety ‘Swarna’ (MTU 7029) following standard agronomic practices except using higher nitrogenous (120 kg ha⁻¹) and lower potassic (30 kg ha⁻¹) fertilizer dose than the normal dose (N₂:P₂O₅:K₂O:100:50:40). For confirming appearance of disease, viz. azoxystrobin 25 SC @ 1 ml l⁻¹, trifloxystrobin 25%+tebuconazole 50% 75 WG’ or Metaminostrobin 20 SC @ 2 ml l⁻¹ may be used as a sole chemical or in combination with other fungicides molecules on the management of rice blast disease. International Journal of Agriculture, Environment and Biotechnology 5: 247-251.


