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YIELD POTENTIAL OF BLAST-INFECTED SEEDLINGS OF RICE

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RINGKASAN

Satu kajian untuk menilai kesan menanam anak semaian jenis Setanjung, Sri Malaysia II dan Jaya yang dijangkiti penyakit karah daun telah dijalankan. Aras keterukan jangkitan didapati kritikal dalam menentukan peratus semaian yang hidup selepas ditanam. Pada aras keterukan 50% terdapat sebanyak 39% semai Sri Malaysia II, 43% semai Jaya dan 81% semai Setanjung hidup, dan hasil padi masing-masing adalah 70%, 71% dan 88% daripada hasil yang diperolehi dari semaian sihat. Sekiranya kita sanggup menerima hanya 5% kesusutan hasil, aras keterukan jangkitan pada semaian hendaklah tidak melebihi 20% bagi Setanjung dan 12% bagi Sri Malaysia II dan Jaya.

INTRODUCTION

Rice crop in Peninsular Malaysia is also exposed to the ravages of rice blast caused by *Pyricularia oryzae*. The pathogen attacks rice crop in both nursery and field (SINGH, 1971). Sowing of susceptible varieties during conditions favourable for blast infections invariably leads to severe leaf blast at the seedling stage. Sometime the spread of the disease is so rapid and severe that farmers are forced to abandon their nurseries and seek seedlings elsewhere or start preparing new nurseries, and thus delaying subsequent field operations.

When initial infections are detected early, spraying of recommended fungicides often arrest further aggravation by the disease. Where infections are not severe, these seedlings are used for transplanting. A study was undertaken in 1982 using seedlings with various levels of leaf blast infection to have a better understanding of the effects of transplanting infected seedlings on rice crop in the field.

MATERIALS AND METHODS

Three rice varieties of known susceptibility to blast, *viz.*, Setanjung, Jaya and Sri Malaysia II (SM II) were used. Seeds of each variety were sown in 90 x 60 x 10 cm wooden boxes. The seedlings were exposed to blast spores in the blast nursery at Bumbong Lima Station, Seberang Perai, at four to five-leaf stage.

When the seedlings were 25 days old, they were pulled out and their reactions to the leaf blast were recorded. Whole seedlings were visually assessed to give an estimate of injury level of 0%, 10%, 20%, 30%, 40% and 50% infection. Seedlings of the same variety and level of infection were then transplanted in the main fields at 25 seedlings per plot and one seedling per point with a planting distance of 25 cm x 25 centimetres. Fertilizer was applied at the rate of 80:30:20 kg N:P:K/ha with half of the N and all the P and K as basal. The remainder of N was applied as two equal top-dressings. The percentage of survival of the seedlings two weeks after transplanting and the grain yields at harvest were determined for each treatment. All treatments were completely randomized in each experimental block which was replicated three times.

RESULTS

The relationships between percentage of survival of seedlings and the levels of seedling infection, and between percentage of survival of seedlings and grain yield were established. Regression of surviving seedlings against levels of injury indicated a

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good fit to the linear model. The regressions were: $y = 107.75-1.37x$ ($r = 0.89$, $P<0.001$), $y = 103.62-1.21x$ ($r = 0.88$, $P<0.001$) and $y = 101.40-0.40x$ ($r = 0.81$, $P<0.001$) for Sri Malaysia II, Jaya and Setanjung respectively, where y is the number of seedlings survived, x is the level of seedling injury and r is the coefficient of correlation *(Figure 1)*. In the three varieties tested, the regression coefficients were statistically significant ($P<0.01$). The regression coefficients for Sri Malaysia II and Jaya (1.37 and 1.21) were similar and significantly different from that of Setanjung (0.40) ($P<0.001$). The combined regression of Sri Malaysia II and that of Jaya was $y = 105.69-1.29x$ ($r = 0.89$, $P<0.001$).

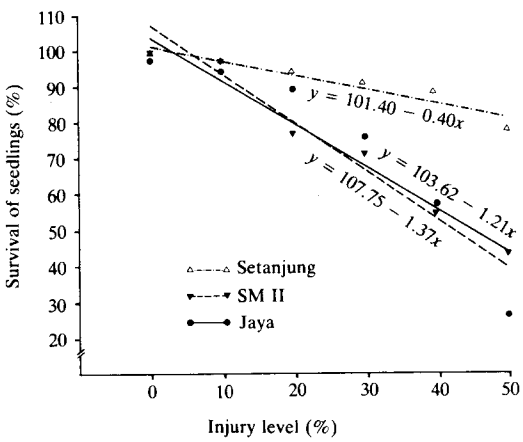

Figure 1. Effect of different levels of infection on survival of rice seedlings at transplanting.

The regression of plot yields against the levels of surviving hills also showed that linear model was a good fit for Sri Malaysia II, Jaya and Setanjung. The regression of plot yields for Setanjung, Sri Malaysia II and Jaya were: $w = 348.05+5.75z$ ($r = 0.88$, $P<0.001$), $w = 364.31+3.86z$ ($r = 0.83$, $P<0.001$) and $w = 366.72+3.66z$ ($r = 0.78$, $P<0.001$) respectively, where w is the plot yield, z is the level of surviving hills and r is the coefficient of correlation *(Figure 2)*. Tests for the differences between the linear regressions were not statistically significant *(Table 1)*. Hence, the yield responses were homogeneous.

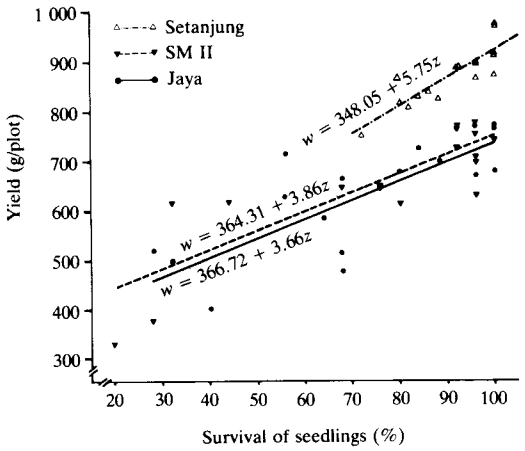

Figure 2. Relationship between survival of seedlings and subsequent plot yield at harvest.

Table 1. ANOVA on regression of yield response to level of surviving hills of Jaya, Sri Malaysia II and Setanjung

Source of variation	d.f.	Mean square	F-test
Joint regression	1	352 722.0	
Heterogeneity regression	2	2 570.4	<1 N.S.
Error	48	3 715.7	

N.S. = Not significant

DISCUSSION

Evidence from this experiment suggests that the blast infection level of seedlings at transplanting is critical for their survival in the main fields. The percentage of seedlings survived differed with varieties and in general, decreased with increasing severity of infection at transplanting *(Figure 1)*. At 30% disease severity, about 67% of the seedlings of both Jaya and Sri Malaysia II survived, whereas for Setanjung almost 90% survived. When the severity was increased to 50% level, the survival rates were 39%, 43% and 81% for Sri Malaysia II, Jaya and Setanjung respectively. The seedlings of Setanjung, though susceptible to blast, were hardier than those of Sri Malaysia II and Jaya, and might have possessed some field tolerance. All those seedlings which withstood infection and survived, regained vigour after trans-

planting and the disease did not spread to the new flush of young leaves that emerged.

The yield from the surviving plants was determined at harvest. It was observed that the variation in yield per hill in Setanjung was very minimal as most of the seedlings survived through to harvesting *(Figure 3)*. However, the yield per hill for Jaya and Sri Malaysia II increased with increasing disease severity of seedlings as a consequent of the surviving seedlings producing more effective tillers per hill to exploit the empty spaces left behind by the dead seedlings.

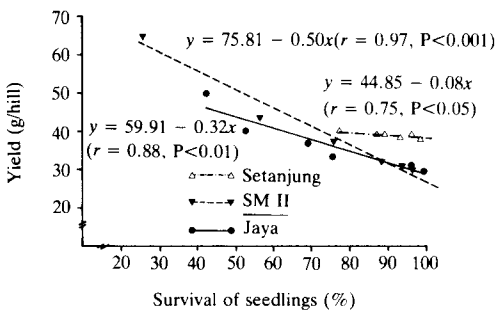

Figure 3. Relationship between survival of seedlings and yield per hill.

Nevertheless, the final plot yield depended on the number of productive hills and the number of filled grains per tiller per hill at harvest. Transplanting Setanjung seedlings with seedling blast rating of 20% resulted in 93% of the seedlings surviving through to harvest and subsequently reducing the grain yield by about five per cent. At 50% disease rating, about 81% of the seedlings survived and the yield was reduced by 12 per cent. However, transplanting seedlings of Sri Malaysia II and Jaya at 50% disease rating allowed, at a maximum, 42% of the seedlings to survive and subsequently reduced yield by as much as 29% and 30% for Jaya and Sri Malaysia II respectively *(Figures 1* and *3)*. For these varieties, on the assumption that only 5% of the yield loss could be tolerated, only seedlings with disease ratings of less than 12% should be used for transplanting. To prevent disease severity from exceeding this limit, fungicides must be used to control the disease.

Setanjung was better than the other two varieties because of its higher yield potential and more stable yield. With proper management practices, yield of more than 5 t/ha is achievable by several farmers. Even if seedlings were infected with leaf blast and used for transplanting in the main fields, more than 80% of the seedlings would survive and the subsequent yields would far exceed those that could be obtained by planting healthy seedlings of Sri Malaysia II and Jaya. In a production system where the farmers are late in detecting nursery blast, such field tolerance characteristics in a variety would be much appreciated for it assures good yield.

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ABSTRACT

The effects of transplanting seedlings infected with leaf blast were evaluated on three rice varieties, namely Setanjung, Sri Malaysia II and Jaya. The levels of seedling infection were critical in determining the survival rate of transplanted seedlings in the main fields. At 50% level of infection, about 39%, 43% and 81% of the seedlings survived and the corresponding plot yields at harvest were 70%, 71% and 88% of those of healthy seedlings for Sri Malaysia II, Jaya and Setanjung respectively. If only a 5% reduction in yield can be tolerated, the levels of infection should not be more than 20% for Setanjung and 12% for both Sri Malaysia II and Jaya.

REFERENCE

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