Relative Density of Weed Species in Transplanted Aman Rice Field in Bangladesh

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Abstract A field experiment was conducted to study the effect of spacing (20 x 10 cm, 25 x 15 cm and 30 x 20 cm) and nitrogen level (0, 40, 60, 80 and 100 kg/ha) on weed infestation in transplanted rice. Transplanted rice was weeded twice—25 and 45 days after transplanting. Before each weeding, observations on weeds were made. Weed species growing in the experimental plots were identified, their number counted species-wise together with rice hills, and the relative density of each species at various spacings and nitrogen levels was analyzed. Results clearly revealed that the relative weed density of each species increased with the increase of the spacing or nitrogen level in transplanted rice. Weed densities were prominent particularly in rice grown at wider spacings, but decreased gradually with the increase of the rice population or decrease of spacing. The effect of the nitrogen level on each of the infesting nine weed species was investigated and attempts were made to quantify the effect using a linear regression model of the form \( y = mx + c \). All the species showed a linear relationship and different behavior with the applied nitrogen. Equations obtained with a high \( r^2 \) value (ranging from 0.818 to 0.973) for each of the species were different from each other, reflecting the variations in the increasing rates of relative weed densities. With the increase in every kg of N/ha, increasing rate of Cyperus iria was highest (0.015% at W1 and 0.017% at W2) among the nine infesting species followed by Paspalum distichum and Scirpus mucronatus. Relative density of weed vegetation of each species associated with the nitrogen level in transplanted rice can be predicted using the equations obtained from the study. However, these results may vary in different agro-environmental areas.

Key words Nitrogen, Spacing, Transplanted rice, Weed density

Introduction

In rice culture, land waterlogged for a long period of time provides an ideal ecological niche for the establishment of weeds. Early in the growing season, aquatic and semi-aquatic weeds dominate but are replaced thereafter by a terrestrial form toward the end of the cropping season when dry land conditions prevail. There is always a certain degree of yield loss due to competition of weeds with crop, which can be minimized but not eliminated. Crop yield loss due to weed com-
petition varies depending upon the magnitude of the infestation, type of weed species grown with crops, time of association with crops, fertilization, competitive ability of the crop variety and cultural management adopted to control the weed\textsuperscript{3,7}).

To keep up with the recent technology in weed management, background information on weed flora and its intensity in crop fields is essential. By monitoring weeds one can accurately identify weed problems. Identification, intensity and information on relative density of different weeds are the pre-requisite for the implementation of any weed control program\textsuperscript{5}). Besides, the knowledge on the growth of weed species leads to the avoidance of toxic weeds to man and removal of such weeds in addition to the evaluations of the need for preventing the introduction and spread of weed species in agricultural and non-agricultural lands\textsuperscript{1}).

Experiments on the emergence, growth response, infestation of weeds depending on the spacing and level of nitrogen fertilizer and the effect of changes in the soil fertility on the composition of the weed flora in transplanted rice have been conducted to some extent in Bangladesh. In another paper\textsuperscript{4}) the absolute density, weed dry matter weight and intensity of infestation were presented. In this paper the relative density of weed vegetation, \textit{i.e.}, the percentage of total weed vegetation at various spacings and nitrogen levels is described. Relationship between the relative density of the weed species infesting a transplanted rice field and the nitrogen level was also analyzed and presented.

**Materials and Methods**

Experimental design and the weather conditions during the study period were outlined in another paper\textsuperscript{4}). However, the experimental procedure and analytical techniques are briefly mentioned here. A field experiment was conducted during the period July ~ November, 1986 at the agronomy field laboratory of Bangladesh Agricultural University at Mymensingh in Bangladesh to study the effect of spacing and nitrogen level in a transplanted rice field. The study consisted of two variables, (i) nitrogen (N) level - 0, 40, 60, 80 and 100kg/ha, and (ii) spacing-row to row plant to plant distance, 20×10cm, 25×15cm and 30×20cm. The experiment was set up in a split-plot design with N treatments in the main plots and spacing treatments in the sub-plots and was replicated four times. Allocation of main and sub-plot treatments was made at random. Thirty three days old seedlings of the rice variety BR 11 were uprooted carefully from the seedling nursery and were transplanted on July 30, 1986 in well-puddled soil using two seedlings/hill. The crop was fertilized with N from urea as indicated in the treatments. In addition to N, 60 kg P\textsubscript{2}O\textsubscript{5}/ha as triple superphosphate and 40 kg K\textsubscript{2}O/ha as muriate of potash were applied as basal fertilizer. The crop was weeded two times 25 and 45 days after transplanting. Before each weeding, data relevant to weeds were recorded. After collection of necessary data, all the remaining weeds from all the experimental plots were uprooted once 25 days (W\textsubscript{1}) after transplanting and similarly again 20 days after W\textsubscript{1}, that is 45 days after transplanting (W\textsubscript{2}). To measure the relative density of weeds, infesting species of weeds in each plot were counted species-wise, prior to weeding by placing a 'quadrat' measuring 1m×1m, from three different locations at random.

The relative density of weeds, \textit{i.e.}, the percentage of total weed vegetation was calculated as\textsuperscript{6})

\begin{equation}
(i) \text{ Relative density of weeds (\%) = } \frac{\text{Total no. of a weed species}}{\text{Total no. of all weed species}} \times 100
\end{equation}

\begin{equation}
(ii) \text{ Relative density of weeds at various N levels (\%) = } \frac{\text{Total no. of weed species at a particular N level}}{\text{Total no. of all weed species}} \times 100
\end{equation}

\begin{equation}
(iii) \text{ Relative density of weeds at different spacings (\%) = } \frac{\text{Total no. of weeds in a particular spacing}}{\text{Total no. of all weed species}} \times 100
\end{equation}

A linear regression model of the form \(y = mx + c\) was used to express the effect of the nitrogen level on the relative density (RD) of each weed species. The following two equations were used to express the relative density in two weeding periods:

\begin{equation}
\text{RD}_1 = a_1 N + a_0
\end{equation}
RD₂ = a₂ N + b₀

Where,

RD₁ = Relative density (%) of weeds 25 days after transplanting (W₁),
RD₂ = Relative density (%) of weeds 45 days after transplanting (W₂),
a₁ and a₂ = rate of increase (% of total weed vegetation) in relative density,
N = Nitrogen,
a₀ and b₀ = constant.

Regression analysis was used to estimate a₀, a₁, a₂ and b₀ from the experimental data.

Results and Discussion

Relative density of weed species

Relative density of the nine weed species is presented in Fig. 1 indicating that the coverage of the weed vegetation by different species at W₁ and W₂ varied considerably.

Variations were also observed between the two weeding periods. It was found that Scirpus mucronatus predominated at W₁ while at W₂ Paspalum distichum predominated. Weed vegetation composed of other species was also found to vary with time, i.e., at W₁ and W₂.

Fig. 1. Relative density/composition of infesting weed species 25 and 45 days after rice transplanting.

Fig. 2. Relative density of weeds at different spacings.
Effect of spacing

Relative density of weeds varied among the spacings. Relative weed vegetation increased at wider spacings of rice and decreased gradually with the decrease of rice hill spacings (Fig. 2).

Similar observations on relative weed density were made both at W₁ and W₂. Relative weed vegetation composed of different species at various spacings is shown in Fig. 3.

![Fig. 3. Relative density of infesting weed species in transplanted Aman rice at different spacings. W₁ and W₂ indicate weeding 25 and 45 days after transplanting.](image)

Effect of nitrogen level

Fig. 4 shows that, with the increase of the nitrogen level, the relative density also increased. At the highest nitrogen level weed vegetation was the largest and the lowest in the control (0 kg/ha). However, the effect of the nitrogen level on the relative density of weed species revealed clearly the effect of nitrogen.

Regression analysis was used for the experimental data to describe and quantify the relationship between the nitrogen level and relative density of each weed species (Fig. 4). The resulting equations (1) and (2) for each of the weed species are presented in Fig. 5.

The results revealed clearly that the relative weed density of each species increased linearly with the increase of the nitrogen level. It was observed that the increasing rate of the relative density was higher at W₁ for Scirpus mucronatus, Paspalum distichum; whereas for Cyperus iria the increasing rate was higher at W₂ than at W₁ (Fig. 5). In case of Jussiaea decurrens, Fimbristylis miliiaceae, Alisma plantago-aquatica, Echinochloa glabrescens the increasing rate of the relative density was similar both at W₁ and W₂. These results suggest that the growth and infestation of Scirpus mucronatus and Paspalum distichum were more pronounced in
August and that in September the growth was reduced. On the other hand, growth and infestation of *Cyperus iria* were less pronounced in August and increased in September. For the other species the growth was identical either in August or September. High $r^2$ values (0.818 ~ 0.973) for each of the equations indicate that the nitrogen level was highly correlated with the relative density of weeds. Therefore, based on the equations obtained, for every kg/ha of nitrogen application in transplanted rice, the probability of weed infestation can be easily predicted as well as the relative composition or density of each weed species in transplanted rice. However, depending on the growing and agro-environmental conditions these results may vary. Therefore, for different agro-environmental conditions, a separate study is necessary to develop a regional/location specific equation, reflecting
of species-wise weed infestation associated with the effect of spacing and nitrogen level.

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References