Dry season irrigated rice yield response to time of sowing in Laos

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Abstract

Dry season irrigated rice experiments were conducted in 2 years at 4 locations; Vientiane (VTN), Champassack (CPK), Xieng Khouang (XK) and Luang Nam Tha (LNT), to determine optimum time of planting, and to identify low temperature effects on seedling establishment and yield. The results indicated that the optimum time of planting was December in Southern and Central Laos where low temperature in the dry season is not a major problem. 1999/2000 (first year) was unusually cold in the Northern area and securing sufficient number of seedlings for transplanting was key to obtaining high yield. Once the crop was successfully established, there was no indication that low temperature limited yield severely. The results of two years of experiments suggested that sowing and transplanting should be conducted at a time when minimum temperature for 10 days is above 10?C in the Northern region. Thus, mid November sowing would reduce the risk of seedling establishment failure in Northern areas.

Key Words

rice; low temperature; crop establishment; germination; grain yield

Introduction

Rice is the most important crop in Laos and the area of dry season rice has increased recently with new irrigation schemes (Schiller et al, 2001). Crop establishment in the dry season often depends on when irrigation water is available (Sihathep et al, 2000). The optimum time of sowing and harvesting for a dry season crop needs to be determined to establish a better double-cropping pattern in these areas. Similarly, varieties are required that are high yielding with appropriate time for maturity. The objectives of this study were to establish suitable times for sowing and to identify whether low temperature during rice establishment limit yield at different locations in Laos.

Methods

Field experiments were conducted in 2 years (1999-2001) at 4 locations, VTN (Central), CPK (South), LNT and XK (North) in Laos. At each location, varieties SK12, RD10 and TDK1 with one local check (TDK 3, Tiane or PN1) were evaluated. The split plot design with 3 replications was used. Time of sowing (S1, S2, S3 and S4) was assigned to main plots and varieties to sub-plots. Pre germinated seeds were sown at about 3 weeks intervals starting from 15 November. Seedlings were transplanted 30-45 days after sowing. Observations were taken on yield and yield components. Daily maximum and minimum temperature were collected from meteorological stations for the duration of the experiment.

Results and Discussions

Mean minimum temperature for 10 days of below 10?C is considered to be an indication of low temperature stress for germination and establishment (Moon-Hee Lee, 2001). In the first year, the southern location had no low temperature period, while in the central area of VTN the minimum temperature was close to the threshold from December to mid February. In the two Northern locations, the low temperature period extended 10 days from mid December to mid January (Figure 1). There was no 10-days minimum temperature below 10?C at any locations in the second year. Varieties behaved similarly in most sowing times at all locations, and hence mean values are presented.

Effect of low temperature on seed germination and growth

In the first year at XK, germination and seedling growth was unsuccessful due to low temperature and crop failed completely in S2. S3 was done on 30 December and young seedlings survived during early cold stage (about 6 days) and produced enough seedlings for transplanting. However young seedlings in S4 were affected by low temperature in late January and produced seedlings only for 2 replications. As at XK, S2 at LNT was also affected by low temperature and produced seedlings sufficient for only 1 replication. S3 was done on 27 December and none of the varieties were germinated due to extremely low temperature (below 10?C) occurred during 12 days (Figure 1). In the second year most of the time, the average minimum temperature during germination and seedling establishment was above 10?C and caused no establishment problem at any location.

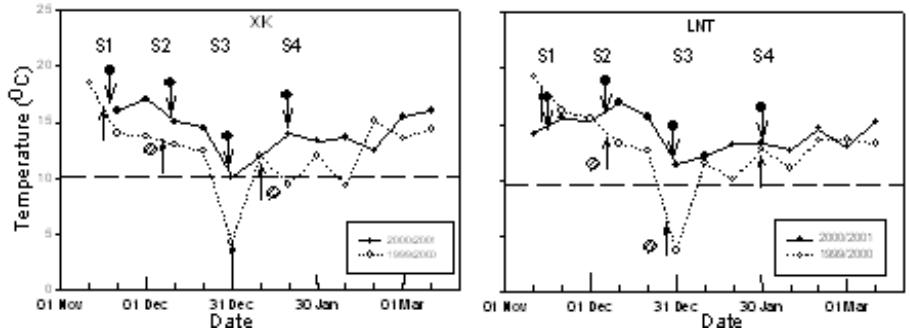

Figure 1. Minimum air temperature (10 days average) during the experiment in 1999/2000 (○) and 2000/2001 (●) at two stations located in the North, LNT and XK . ⊘-indicates the sowing time affected by low temperature. Arrows indicate sowing time (S1-S4)

Effect of sowing dates on grain yield

In the first year, grain yield varied greatly depending on the time of sowing and location, while genotypic variation was not significant. At CPK and VTN showed similar response to sowing date; the yield was lower in S1 and the highest in S2-S3 with yield decline in S4. At LNT, the mean yield was over 2.50 t ha^{-1} for the first sowing. S2, S3 and S4 had no or low yield, because of the low temperature problem in germination /establishment (S2, S3) and the birds and insects damage before harvesting (S4) (Table 1).

Table 1. Mean grain yield (t ha^{-1}) of 4 varieties planted in 4 times at 4 locations in 2 year.

	1999/2000 season				2000/2001 season			
Sowing	CPK	VTN	LNT	XK	CPK	VTN	LNT	XK
S 1	2.10	3.15	2.64	3.15	2.01	2.01	4.61	3.41
S 2	4.62	4.52	0.91	0.00	3.42	2.79	4.21	3.42
S 3	4.51	3.81	0.00	3.50	4.21	1.99	4.31	3.41
S 4	4.36	3.04	0.00	1.66	2.02	2.01	3.82	3.40

Mean	3.90	3.63	0.88	2.07	2.92	2.20	4.24	3.41
Lsd 5%	1.60	1.35	1.20	1.11	2.01	ns	ns	ns

At XK, yield was nil to low in S2 and S4 due to low temperature in the nursery stage, but mean yield of other sowing between 3.15 and 3.50 t ha^{-1}. In the second year, there was no large yield variation across time of sowing at each location. However, the extremely high temperature (34?C) during flowering at CPK resulted in a low yield in S4. The yield was consistent across sowing time at LNT and XK where the temperature is above 10?C during sowing/establishment. Because of some water limitation at VTN in the 2^{nd} year, grain yield was lower than in the 1^{st} year.

References

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