

The contingency table chi-square test revealed significant differences in survival rates among the four stand conditions ($\chi^2=39.96$, $df=3$, $p<0.001$). Survival rates ranked as follows: $0.7>0.6>0.8>0.5$. Pairwise comparisons indicated that survival under canopy closure 0.7 was significantly higher than under 0.5 and 0.8 ($p<0.001$), and survival under 0.6 was significantly higher than under 0.5 ($p<0.001$). No statistically significant difference was detected between 0.6 and 0.8.

Relative risk analysis showed that the establishment survival rate under canopy closure 0.7 was approximately 1.58 times that under closure 0.5, with the 95% confidence interval not crossing 1. Overall, survival increased as canopy closure rose from 0.5 to 0.7 and declined at 0.8.

3.3 Integrated response characteristics of nursery mode and stand conditions

The stage-wise results showed that container substrate nursery modes exhibited higher survival during the cutting phase. In the field establishment experiment, survival under canopy closure levels of 0.6~0.7 was generally higher than under 0.5 or 0.8, with the highest survival rate (95%) observed at canopy closure 0.7. In contrast, survival declined under both lower and higher closure levels. These results reflect differences in establishment survival across nursery modes and stand conditions. As the experimental design did not constitute a fully factorial combination, the integrated response characteristics are based on stage-wise comparisons.

3.4 Summary of the response pattern between canopy closure and survival

To examine the relationship between canopy closure and establishment survival rate, scatter fitting was performed between canopy closure values and corresponding survival rates (Figure 3). The results showed a near-unimodal response pattern along the canopy closure gradient. Survival increased progressively as canopy closure rose from 0.5 to 0.7 and declined at 0.8.

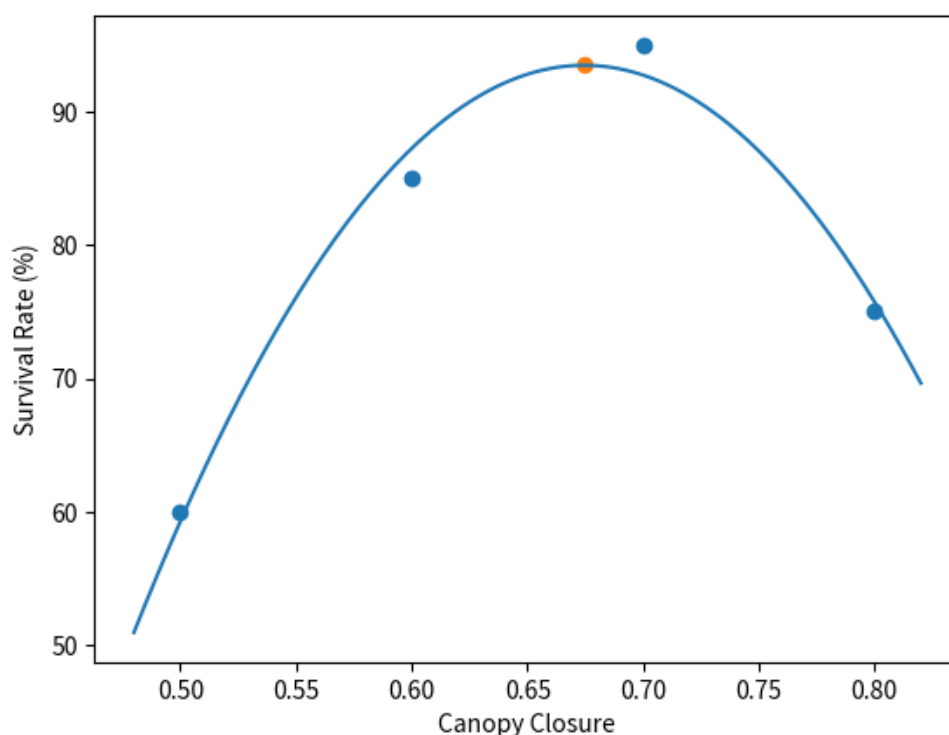


Figure 3 Response of survival rate to canopy closure

A quadratic polynomial model was applied for descriptive fitting, and the vertex of the fitted curve corresponded to a canopy closure of approximately 0.67, with a predicted survival rate of approximately 93%~94%. The fitted trend was consistent with the observed data pattern. Given that the canopy closure gradient consisted of only four discrete levels and that stand type and cultivation method differed among plots, the fitted model is primarily descriptive and used to delineate the range associated with higher survival. Based on both fitted results and observed data, the optimal canopy closure range for *T. hemsleyanum* establishment was defined as 0.6~0.7.