Patterns of Partitioning of Dry Matter in Rice with Different Transplanting Dates

M. H. Lee, J. C. Shin*, Y. J. Oh and R. K. Park
Crop Experiment Station

Objective

Characterization of the growth of rice plant in different growth conditions

Matterials and methods

In 1989, a field experiment was conducted at the Crop Experiment Station in Suwweon, Korea. Four leading rice varieties, Odaebyeo, Hwaseongbyeo, Daecheongbyeo as japonica and Yongmoonbyeo as indica/japonica were transplanted on May 6, May 21, June 5 and June 20. The seedlings of the four varieties were grown for 40 days in semi-irrigated nursury beds covered with a poly ethylene film. Three seedlings per hill were transplanted by hand at a density of 30 x 15 cm. Nitrogen, phosphorus and potassium were applied at the rate of 110 - 70 - 80 kg ha^{-1}. Nitrogen was split in 40, 30 and 30 % as basal, top dressing at two weeks after transplanting and at panicle initiation stage (25 days before heading), respectively. Phosphorus was applied 100 % as basal and potassium was split in 70 % and 30 % as basal and top dressing at panicle initiation, respectively.

Water management, weeds, pests and diseases were well controlled to sat-isfy the requirement for potential production.

From transplanting to harvest, every week tiller numbers were counted and plant height was measured on 20 hills in all plots. To determine the total dry matter and leaf area, in each plot weekly, 12 hills with the same average number of tillers as in the 20 hills were sampled randomly. At maturity, a sample of 5 m^2 was harvested from each plot to measure grain yield.

The data from this experiment were used to provide basic data about dry matter partitionting in the rice varieties, and for evaluation of the model.

Results

The distribution of dry matter over the various plant parts differed in the development stage among varieties and transplanting dates. The ratio of daily growth in dry matter of leaves over that of stems was studied more detail. The course of this ratio over the development stage of the crop showed a similar trend for all cultivars and all transplanting dates, and could be described by following equation:

$$dL/dS = a \cdot (1-e^{(-k.(1-DS))}) + c$$

Results of the present study indicate that there is a difference in dry matter partitioning in different varieties and transplanting dates under temperate weather conditions, showing a strong seasonal trend. The cause of this variation in dry matter partitioning needs to be studied to simulate more accurately the growth and yield formation of the rice crop.

The model can help physiologists to understand the consequences for production of changing a plant property, such as the dry matter patitioning and can help breeders to determine physiological and morphological features of varieties that contribute most to increasing production.

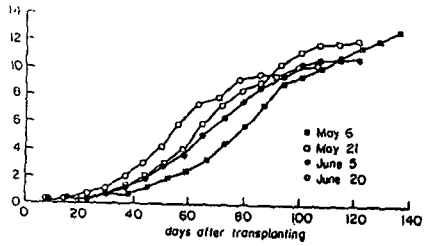

Figure 1. Time course of observed total dry matter accumulation of rice cv. Hwaseongbyeo at different transplanting dates: May 6 (□), May 21 (□), June 5 (•) and June 20 (○) in 1989 in Korea.

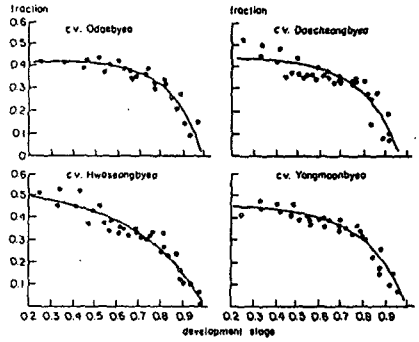

Figure 3. Relation between observed assimilate partitioning to the leaves and development stage for four varieties of rice at four transplanting dates.

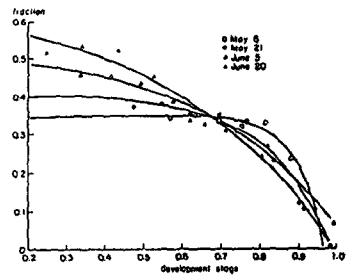

Figure 4. Relation between observed assimilate partitioning to the leaves (symbols) and development stage of rice cv. Hwaseongbyeo at four transplanting dates. Solid lines are calculated with Equation 1, using different parameter values, see text.

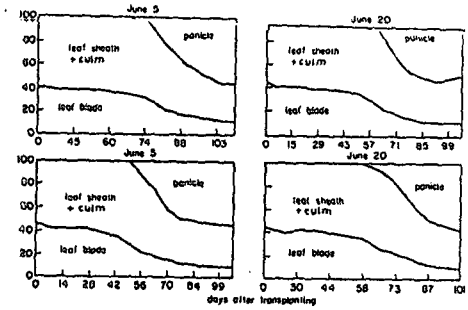

Figure 2. Partitioning to different plant parts of rice cv. Odaebyeo at four different planting dates May 6 and 21, June 5 and 20, in 1989.

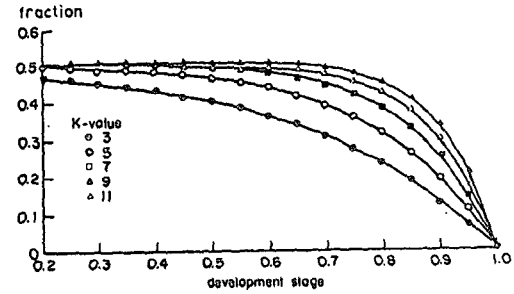

Figure 5. Relation between assimilate partitioning to the leaves and development stage calculated with different k-values in Equation 1.

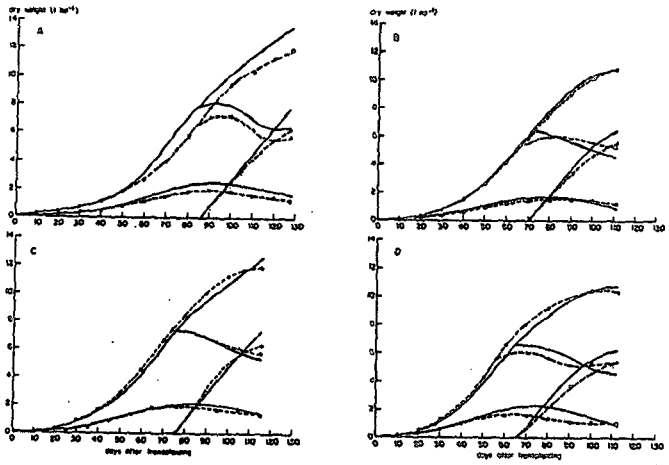

Figure 7. Comparison between observed (dashed lines) and simulated (solid lines) weights of total dry matter (○), stem (△), leaf (□) and storage organs (○) for rice cv. Hwaseongbyeo transplanted on May 6 (A), May 21 (B), June 5 (C) and June 20 (D).