講演要旨

Root - Shoot Relationship in Rice

Jin Chul Shin*, Moon Hee Lee*
and Yong Woong Kwon**

* National Experiment Station, Suweon 441-100, Korea,
** Department of Agronomy, Seoul National University,
Suweon 441-744, Korea

Root surface makes up the interface with below ground environment and determines the efficiency of obtaining external resources, such as water and nutrients. In the conditions of ample water and nutrients, an excess root system reduce the growth of shoot due to the competition or carbohydrates between root and shoot. However, the traditional statement "the more root the better" is generally accepted in agriculture. The root zone soil hardly supplies sufficient water and nutrients in normal agriculture. Below ground resources are stored temporarily in the root environment. This implies the importance of root - shoot relationship.

In this paper we will discuss the root - shoot relationship in rice: length, weight, rooting pattern and shoot/root ratio in relation to external nitrogen situation and different growth stage to understand the ideal type of root system in lowland rice.

Root length and shoot dry weight

Uptake rate depends on the root surface area as photo synthetic rate depends on leaf area. The diameter of the rice root are more or less analogous to one another even though varieties are different. Therefore, the root surface area depends on the total length of root. Linear relationship were found between the shoot dry weight and the natural logarithm of root length per plant at various growth stage in different rice varieties (Shin, 1989).

Root length and aboveground characteristics

Genetic control of root growth is apparently independent of genes for stem growth and selection on above ground characteristics does not directly lead to a change in root system characteristics (Wright et al., 1983). No clear relationship was found between the root length and shoot dry weight of 13 rice varieties at heading. Among several aboveground characteristics of 13 varieties only panicle number per plant had significant relation to the root length at heading.

Root number and tiller

Root density in soil profile is strongly dependent on the total number of roots per hill. Root spring out from node and the total number of nodes per plant determine the total number of roots even if the varietal differences in the average number of roots are observed. The number of roots per plant are closely related to the number of tillers per plant in a variety under the different nitrogen application level and different planting densities.

Rooting pattern and shoot

Three types of rooting pattern which determine the root density in soil profiles are characterized in rice varieties: horizontal vertical and intermediate types. Two parameter model which describes the root length density in a distance from the plant base was developed.

The higher root density in subsoil layer of 10 to 25 cm profile, the higher nitrogen content in leaf blade. The amount of dead leaf are positively related to the root length in the surface soil layer till 10 cm profile.

Shoot/root ratio

One gram of root supported 3 to 4 gram of total dry matter under the no nitrogen treatment at early growth stage and it increase gradually after maximum tillering stage. It was about 4 grams in the condition of 40 and 100 ppm solution N concentration at the beginning, 7 to 10 grams at maximum tillering stage and about 14 grams at heading stage.

Dry matter partitioning to the root decrease as the growth stage advanced. The higher external nitrogen concentration the less dry matter partition to the root. The uptake rate of nitrogen under 100 ppm external nitrogen concentration was about 0.04 g N/1 gram root at active tillering stage and it was gradually decreased till heading.

Reference

Shin, Jin Chul 1989. Characterization of root distribution of rice cultivars and the response of root growth to planting density in relation to shoot growth and grain yield. Ph.D. thesis, Seoul National University.

Shin, Jin Chul, Yun Jin Oh and Eun Woong Lee 1993 Characterization of the growth and spatial distribution of lowland rice root. Proceedings of the 1st ACSA. 391-389.

Wright, G. G. and R. G. G. Smith 1983. Differences between two grain sorghum genotypes in adaptation to drought stress. II. Root water uptake and water use. Aust. J. Agric. Res. 34:627-636.