Comparison of Root Distribution Pattern between Gramineae and Legume Species under Various Soil and Climate Condition

Shinji SUZUKI[1*], Yukimitsu KOBAYASHI[2], Fumio WATANABE[1], Daichi NAKAGAWA[3], Taisuke IZUMIKAWA[4]

[1] Tokyo University of Agriculture, [2] NTC International Co.Ltd., [3] East Japan Railway Co., [4] Cherry Consultants Inc.

Introduction

➢A quantitative evaluation of the root system is necessary to discuss a relationship between plant growth and the soil environment.

➢Although there are a number of root system evaluation methods, little studies to investigate a relationship among each method have been undertaken, particularly, between length and special distribution of the root.

➢The current study analyzed a relationship between the ***Root Frequency Impact*** (**RFI**), which is one of indices to indicate the spatial distribution of the plant root, and the ***Root Length Density*** (**RLD**) which is another index to evaluate the root length of plants.

RFI (%) = percentage of cells containing at least a root in each depth

Transparent plastic sheet with 20 × 20 mm cells

Nicoullaud *et al*. (1994) & Lesturgez *et al*. (2004)

RLD (m m^{-3}) = length of the root per unit volume of the soil

The intersect method

Newman (1966) & Marsh (1971)

Material and Method

➢Under different condition (i. e. location, soil type, crop type, and field/pot), cropping experiment was undertaken as shown in Table 1.

Table 1. Conditions for crop experiment.

	Case 1	Case 2	Case 3	
Location	Mahasarakham, Thailand	Ibaraki, Japan	Tokyo, Japan	
	Field	Field	Pot	
Soil type	Arenosol	Andosol	Alluvial soil	Andosol
Gramineae	*Andropogon gayanus*; Gamba	*Zea may*; Maize	*Zea may*; Maize	*Zea may*; Maize
Legume	*Stylosanthes guianensis*; Stylo	*Glycine max*; Soybean	*Glycine max*; Soybean	*Glycine max*; Soybean
Sowing	July, 2001	August, 2007	July, 2016	July, 2016
Root observation	June, 2004	October, 2007	August, 2016	August, 2016
Remark	Compacted subsoil existing at a depth of 0.15 to 0.35 m		Compacted and uncompacted conditions were prepared for both types of soil	

Results and Discussion

➢As Root system of Gramineae(i.e. Gamba and Maize)is classified as the fibrous root system, developed widely than Legume (i.e. Stylo and Soybean) which is classified as the taproot system (Figs. 1 and 2).

➢Both RFI and RLD indicated clearly the difference of root distribution patterns between Gramineae and Legume (Figs. 1 and 2).

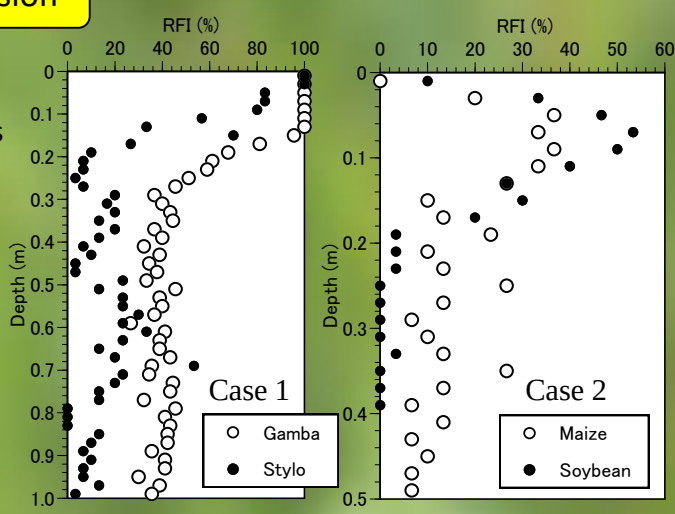

Fig. 1. Profiles of Root Frequency Impact (RFI).

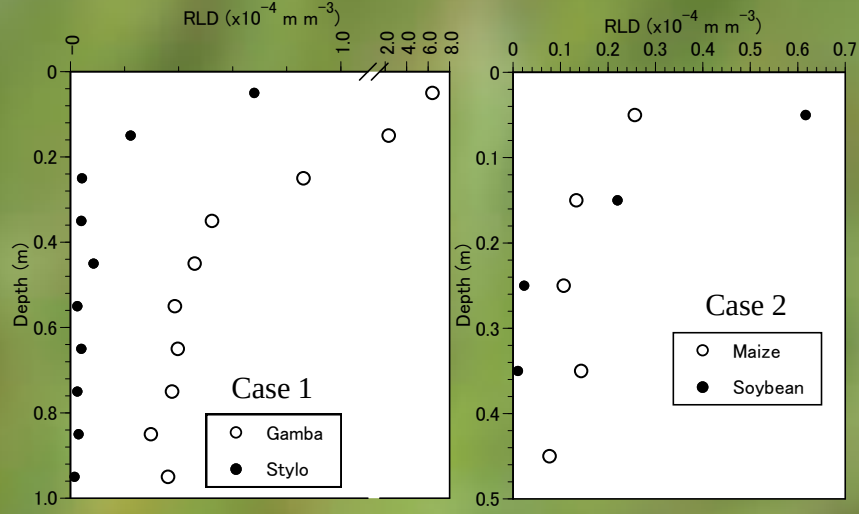

Fig. 2. Profiles of Root Length Density (RLD).

Conclusion

➢Independent of conditions and crop types, the RLD obviously correlated to the RFI as shown in Fig. 3.

➢The RLD increases exponentially as the RFI increases indicating development of the root length results in spatial development of the root.

➢A regression equation shown in Fig. 3 is useful to estimate the RLD from the RFI.

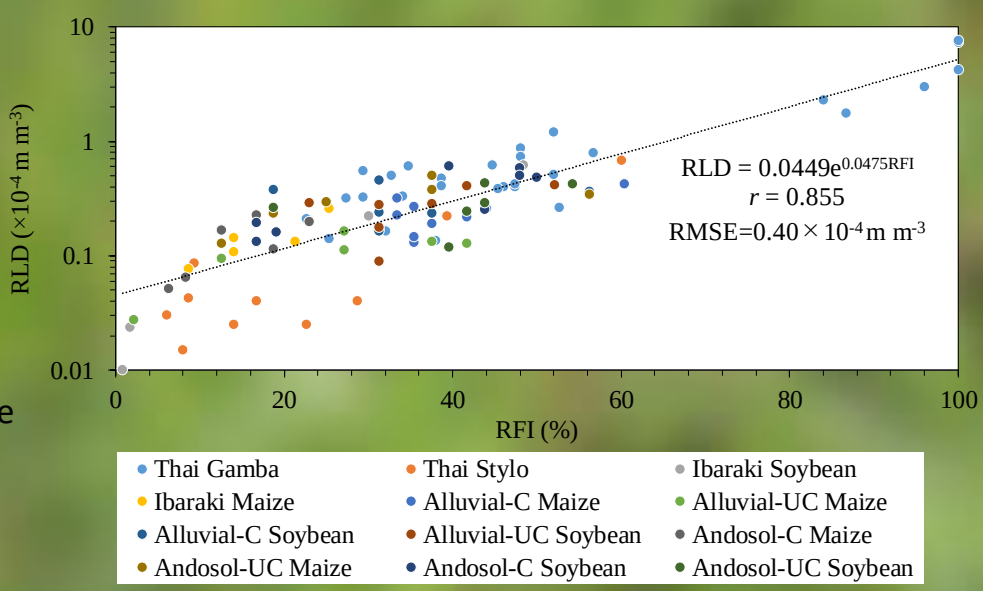

Fig. 3. Relationship between RFI and RLD. C: compacted, UC: uncompacted.

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