

벼 직파재배시 뿌리분포 특성

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Characteristics of Root Distribution in direct Seeded Rice

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Objectives : To obtain the basic information on root growth and understand the morphology of root distribution under the direct seeded rice using different varieties (Korea, Japan, USA)

Materials and Methods

This experiment was conducted by Root box-pin board method.

Specially devised root box, made of polyethilen plastic was adopted in this study.

Different varieties, Gancheok, Nonzan, Dongjin of Korea, Hitomebore, Hatsuboshi, Koshihikari of Japan, M202, Calrose, Caloro of USA, were used in the experiment. the size of root box was 50x50x3cm.

Sprouted seeds were sown in the middle of root boxes with two seeds per each box and 22 days seedlings of Hatsuboshi were transplanted as a check. All the boxes were placed on bathtub pot with standing water just below the top of the root box.

Root observation was done at 28 days after heading and roots were washed out by tap water very carefully. After removing the attached soil, all the roots were fixed on pin board and photographs were taken. Samples were taken at 5cm interval soil depth and dried in the oven at 80°C. Top of the plants as well as root samples were dried and weighed.

Result, and Discussion

Varietal difference in the dry matter partitioning ratio root and top plant was observed. USA varieties, especially M202, Caloro were recorded high ratio. Caloro had amount of roots and vigorous top growth, on the other hand Koshihikari was shown lowest ratio of R/T due to small amount root and top plant. Mostly Japan cultivars except transplanted Hatsuboshi were low ratio.

The roots were sampled as Fig. 1. The root obtained from root box were measured by pin board. Root distribution to each soil block were recorded. All the varieties were distributed block A, C, E in middle of box, just below the plant base.

Dongjin, M202 and caloro were distributed deeper than the others.

Root of transplanted Hatsuboshi was developed much better than direct seeded Hatsuboshi.

Among the 9 varieties, total root weight density was highest in Caloro followed by Dongjin, Gancheok, Calrose and the others.

In case of Caloro, root density was twice as much as the others besides Dongjin,

According to cumulative percent of root distribution on each soil layer, all the roots were distributed below 20cm, in case of USA varieties, were around 60%, suggesting that those roots developed well deeply compared to others.

Fig. 2. shows vertical distribution varied among the 9 varieties. In this figure, a large amount of roots was distributed in top 15cm soil layer in Hatsuboshi and Koshihikari, and their root systems appeared to be shallow. In contrast, the roots distributed in the top 10cm soil layer were small in Dongjin, Calrose and Caloro. Their root systems were relatively deep.

Table 1. Varietal difference in dry matter partitioning ratio to at beginning of ripening stage under the direct seeded rice.

Variety	Heading date	Dry weight (g/root box)		R/T (%)
		Root(R)	Total(T)	
Gancheok	Aug. 21	5.06	39.24	13.2
Nongan	Aug. 18	4.64	31.13	14.9
Dongjin	Aug. 24	6.17	43.85	14.1
Hitomebore	Aug. 9	3.56	31.00	11.5
Hatsuboshi	Aug. 9	2.59	23.24	11.4
Hatsuboshi ^(T)	Aug. 2	4.54	36.94	14.6
Koshihikari	AUG. 16	2.42	25.71	9.4
M202	Aug. 9	4.50	27.94	16.1
Calrose	Aug. 2	5.05	36.76	13.7
Caloro	Aug. 16	9.44	58.04	16.3
LSD(0.05)		0.45	3.02	0.89

(^T): Hatsuboshi was transplanted with 22 days seedling
(T): Total dry weight of upper ground part and root

Table 2. Varietal difference in root distribution to each soil block obtained from the root box

Variety	Root weight density(x10 ⁻¹ mg/cm ³)									Total
	A*	B	C	D	E	F	G	H	I	
Gancheok	56.4	2.9	29.8	7.3	21.7	6.2	12.4	3.3	3.7	7.53
Nongan	68.0	1.8	21.8	6.2	20.9	6.0	4.9	7.3	2.7	7.17
Dongjin	69.7	9.6	29.2	10.4	17.7	4.9	10.7	6.0	3.1	9.14
Hitomebore	46.7	3.1	23.5	4.4	12.4	4.4	6.2	4.0	2.0	5.27
Hatsuboshi	41.7	4.7	25.8	2.7	12.9	2.0	4.0	0.9	0.4	3.84
Hatsuboshi ^(T)	33.7	5.8	25.7	7.1	16.9	6.4	9.1	5.7	3.3	6.73
Koshihikari	36.0	4.2	15.7	3.1	8.4	2.2	5.3	1.1	1.2	3.59
M202	57.3	4.2	33.7	7.3	10.2	5.5	5.3	3.3	1.8	6.67
Calrose	40.0	2.0	33.3	5.1	15.5	6.4	8.4	6.9	4.8	7.48
Caloro	51.5	2.7	41.3	9.7	28.4	3.1	28.0	14.2	10.4	13.21
LSD(0.05)	11.2	2.4	5.4	1.9	3.9	1.3	2.5	1.2	0.8	1.9

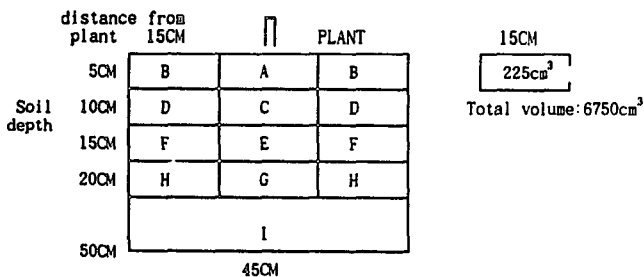


Fig. 1. Provisional name of each soil block in root box-pin board method

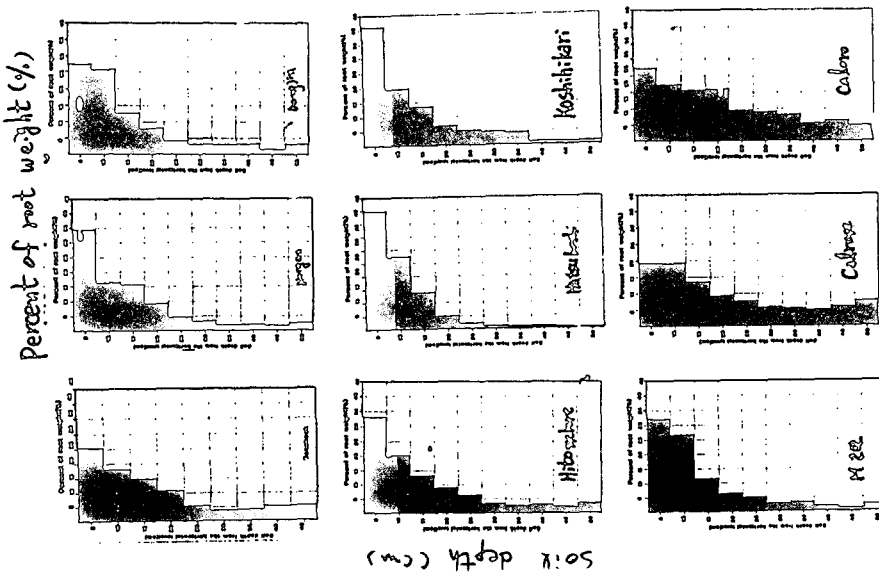


Fig. 2. Varietal difference in Root distribution in direct seeded rice.

Table 3. Varietal difference in ratio of root distribution on shallow layer

Variety	Cumulative percent of root weight on each soil layer of soil			
	0-5	5-10	10-15	15-20cm
Gancheok	25.7	44.1	59.3	60.4
Nongan	34.7	51.3	67.2	76.7
Dongjin	27.6	53.5	66.6	76.7
Hitomebore	33.4	53.9	69.4	74.9
Hatsuboshi	45.2	72.2	86.5	91.5
Hatsuboshi*	22.4	42.3	57.1	70.3
Koshihikari	41.4	61.4	75.4	82.5
M202	32.4	40.6	52.5	59.2
Calrose	19.6	39.1	52.9	62.4
Caloro	13.6	28.2	47.1	63.4

* : Hatsuboshi was transplanted with 22 days seedling