Studies on Agronomic Characters in Reciprocal Translocation Homozygotes of Rice¹⁾

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The X-ray induced RT (Reciprocal Translocation) homozygotes did not show any marked difference in morphological characters from normal plants. Therefore, it seems that no major genic changes are involved in the translocation lines. However, in agronomic characters which are controlled by polygenes, some changes may or may not occur together with translocations. In view of this respect, a number of translocation homozygotes were compared regarding quantitative characters.

The RT homozygotes which included 10 lines of the variety 504 (Taichung No. 65, a representative of Ponlai variety in Taiwan) isolated by the senior author, and 10 lines of the variety 108 (Pei-Ko, an Indica variety in Taiwan) and 7 lines of the variety 521 (Kissin, a Japonica variety) isolated by the junior author listed in Table 1, were used as the materials of this experiment. A genetically pure-line of each variety was used for producing those translocation lines.

Table 1. List of RT lines used

Pei-Ko		Kissin		Taichung No. 65	
No.	Original line no.	No.	Original line no.	No.	Original line no.
A 1	108TH 3-3-4	B 1	521TH 5-6-3	C 1	504TH 2-2
A 2	" 8-8-7	B 2	" 13-1-3	C 2	" 4-4
A 3	" 9-2-6	B 3	" 23-2-4	C 3	" 6-4
A 4	" 10-5-3	B 4	" 24-2-4	C 4	" 7-7
A 5	" 11-6-2	B 5	" 25-4-7	C 5	" 11-5
A 6	" 12-2-9	B 6	" 26-5-3	C 6	" 12-8
A 7	" 16-8-8	B 7	" 33-1-6	C 7	" 14-1
A 8	" 18-7-2			C 8	" 17-8
A 9	" 19-8-4			C 9	" 33-7
A 10	" 21-4-8			C 10	" 39-4
A 0	108CK	B 0	521CK	C 0	504CK

Seeds of the above lines were sown on January 20, 1960, and the seedlings were transplanted to the field on March 4. The lines were tested in a randomized block experiment with three replications. In each replication, a line consisted of 10 plants. Hills, each consisting of a plant, were spaced at 24 cm in both directions. The standard mixture of fertilizers was applied.

Heading date was observed during the growing season at the interval of two days.

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At maturity, plant height, number of tillers and number of panicles were recorded on an individual plant basis. The plants were then harvested for measuring yield. The results are given in Tables 2 and 3.

From the data in the tables the following conclusions may be drawn.

(a) Heading date: Variance analysis of the data (Table 3) showed that there was no significant difference between the lines tested.

(b) Plant height: As shown in Table 3, some significant differences were seen between lines of variety 108, but were not found among lines of other varieties.

(c) Numbers of tillers and panicles: No significant difference was found between lines in all three varieties.

(d) Grain yield: No significant difference was found among lines of 521 and 504, but a difference at 5% level was found between lines of 108.

Table 2. Average values for plant height, number of tillers, number of panicles and grain yield in RT homozygous lines

RT	Homozygous lines	Plant height (cm)	Num. of tillers	Num. of panicles	Grain yield (kg)	Total Num. of plants
108TH	A1	103.3	17.1	14.7	1.05	120
	A2	102.5	17.6	15.7	1.07	120
	A3	108.1	16.3	14.5	1.16	120
	A4	108.3	16.8	15.4	1.19	120
	A5	106.9	17.1	15.6	0.92	120
	A6	112.8	17.9	15.3	1.08	120
	A7	112.8	16.1	14.3	1.05	120
	A8	111.6	17.4	15.6	1.18	120
	A9	112.2	16.2	14.5	1.14	120
	A10	107.4	16.3	15.2	1.20	120
CK	A0	105.7	16.1	14.8	1.03	120
521TH	B1	92.5	14.7	14.5	1.30	120
	B2	89.1	17.1	13.6	1.30	120
	B3	89.5	17.1	16.5	1.25	120
	B4	90.2	17.3	16.7	1.17	120
	B5	89.1	15.8	15.6	1.05	120
	B6	90.9	17.6	17.4	1.25	120
	B7	86.0	17.3	16.9	1.09	120
CK	B0	88.6	16.5	15.9	1.16	120
504TH	C1	95.1	12.4	12.3	1.23	120
	C2	98.5	13.3	13.0	1.18	120
	C3	96.7	12.9	12.7	1.17	120
	C4	94.8	12.2	12.1	1.15	120
	C5	97.5	12.7	12.5	1.10	120
	C6	94.6	13.2	13.1	1.23	120
	C7	99.3	13.6	12.9	1.19	120
	C8	97.1	13.6	11.9	1.13	120
	C9	95.5	13.2	12.7	1.21	120
	C10	102.9	11.5	11.3	1.26	120
CK	C0	103.0	12.4	12.1	1.17	120

Table 3. Analysis of variance for various agronomic characters of RT homozygotes

Variety	Source of variation	D.F.	Heading time		Plant height		Number of tillers		Number of panicles		Grain yield		Point of significance	
			Mean square	F value	Mean square	F value	Mean square	F value	Mean square	F value	Mean square	F value	5%	1%
108TH	Between lines	10	140.26	0.026	36.166	13.405**	1.445	1.02	0.764	1.07	0.0214	2.78*	2.36	2.89
	Replication	2	8.45		0.555		8.351		2.97		0.0195			
	Error	20	5,452.26		2.698		1.415		0.739		0.0077			
521TH	Between lines	7	1.749	2.58	10.93	2.726	1.435	1.14	1.76	1.45	0.0307	1.48	2.77	2.89
	Replication	2	0.263		6.21		1.54		1.44		0.0556			
	Error	14	0.679		4.01		1.24		1.21		0.0207			
504TH	Between lines	10	0.625	0.197	23.15	2.514	1.124	1.75	0.907	1.87	0.0064	1.391	2.36	2.89
	Replication	2	0.93		39.87		1.315		0.820		0.044			
	Error	20	0.318		9.21		0.644		0.484		0.0046			

* Significant at 5% level

** Significant at 1% level

Roberts (1942) studied 13 lines with different interchanges of corn obtained from an inbred line by X-raying, comparing them with each other and with the original inbred line. There were found no conspicuous new characters, but small statistically significant differences in quantitative characters among the lines. The conclusion was that "position effects" might be involved but mutations could not account for all the changes found.

In *Datura*, Blakeslee, *et al.* (1940) reported that in their collection of over 90 prime types (homozygous for segmentally interchanged chromosomes), most were not distinguishable from normal plants but a few were distinctly abnormal. They could not determine whether the changes in character were due to gene mutations or small deficiencies linked with point of breakage, or to position effect.

In rice, from the results of the present observations on the various agronomic traits in translocation homozygotes, it may be said that translocation lines are generally homogeneous in agronomic characters and may be regarded as having the same genotypes except for translocations. There may be no major "position effect" of genes, though sometimes a translocation may be accompanied by genic changes as found among lines of the variety 108.

Artificially induced chromosomal interchanges may be useful for establishing linkage groups as pointed out by Kramer (1954), Burnham (1955) and Anderson (1945). It is also useful to locate given genes on a chromosome by using linkage relationships with a certain marker gene to the relevant chromosomes. This work is now under way in the writer's laboratory. As mentioned above no difference was found in quantitative characters among translocation homozygotes. Accordingly, the translocation method may be used to some extent for locating quantitative characters on chromosomes.

Summary

The RT homozygotes, 10 lines of 108 (Pei-ko), 7 lines of 521 (Kissin) and 10 lines of 504 (Taichung No. 65) were tested in a randomized block experiment. Various agronomic characters which are controlled by polygenes were measured and variance analysis was made. It was found that the translocation lines are generally homogeneous in agronomic characters and may be regarded as having the same genotype for translocation. However, translocation may sometimes be accompanied by genic changes. It was assumed, further, that the translocation method may be used to some extent for locating quantitative characters on chromosomes.

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稲の相互転座ホモ系統における有用形質について

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X線処理によつて作出した稲の相互転座ホモ系統白穀（台湾在来種）10 系統，吉神（日本種）7 系統及び台中 65 号（台湾蓬莱種）10 系統を用いて圃場試験を行ないポリジーン (polygene) によつて支配される種類の有用形質について調査を行なつた。統計分析の結果から転座

ホモ系統間に於ける各有用形質は少数の例外はあるが，一般的に極めて均一 (homogenous) であることが分り染色体に転座が起つている以外，各系統の遺伝子型は同一であると思われた。よつて相互転座法によりある程度迄ポリジーンの分析ができると想定された。