Photoperiodism in the Genus *Oryza*

X. Combinations of plant age, day length and accumulation effect of short day condition (2)

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On an accumulation effect of short day condition (abbreviated as accumulation effect, and so forth), comparison between continuous and discontinuous short day cycles had been made^{1,6,7,8)}, using strains of cultivated species, *Oryza sativa* L. The author's aim of this investigation-series was consistently to study photoperiodism of cultivated and wild species in the hope of getting useful information on phylogenetic differentiation and of getting useful validity of the genus. Previously, accumulation effect produced by short day condition was investigated⁴⁾. Further experiments was conducted using 8 strains in order to investigate photoperiodic sensitivity and effect of short day with different day length, and that of intercalated long day during short day period⁵⁾. Additional experiments using different 12 strains were conducted and results obtained will be presented.

Materials and Methods

Previously⁵⁾, 8 strains classified as Groups 1, 2 and 3 in the other paper⁴⁾, were used, while different 12 strains classified as Groups 4 to 11 in the previous paper⁴⁾, were used here. They belong to different species of the genus *Oryza*; 1 *O. sativa* (from Sarawak), 3 *O. glaberrima* (from Sierra Leone), 3 *O. sativa* var. *spontanea* (from Brunei, Malaya and New Guinea), 3 *O. perennis* (from Philippines, Kalimantan and Brazil) and 2 *O. officinalis* (from Brunei and Sarawak). Procedure of cultivation and detection of heading date were the same to those mentioned in the previous paper³⁾.

Seeds were sown on May 2. Plants were grown under the natural day length until the starting of the short day treatment,

during the interruption by long day condition and after the treatment. The treatment was started at 80 and 85 days after the sowing. Plants were divided into 101 plots, 3 plants in each, and 1 plot was remained under the natural day length during the whole growing period as the control plot. Plants in the other 100 plots were subjected to 5 short day conditions, 11.0, 11.5, 12.0, 12.5 and 13.0 hours light and 13.0, 12.5, 12.0, 11.5 and 11.0 hours dark cycles, respectively. Experimental plots are illustrated in Fig. 1. Suitable temperature (25° to 30°C) was provided for the growth of plants.

Results and Discussion

1. Results obtained are shown in Table 1. Groups are arranged in the order of efficiencies, which was illustrated by the values from those of the respective control plot. Within each group, strains are arranged in the order of species and strain number. Within each strain, the data are arranged in the order of day length.

In a broad sense, 12 strains used can be classified into 8 groups based on the patterns of accumulation effects. In a strict sense, however, variations were found within the same strain. In strain W0623, plants subjected to 11.0 hours light and 13.0 hours dark cycles (abbreviated as 11.0 hours light, and so forth) responded clearly in plot III, although plants subjected to other day lengths did not respond in this plot. Responses of plants of the former can be newly classified into Group 3⁴⁾, although responses of plants of the latter can be classified as usual into Group 4. In strain W1269, plants subjected to 11.0 hours light

responded clearly in plot XIX, although plants subjected to other day lengths did not respond in this plot. Responses of plants of the former can be classified into new Group, although the responses of the latter can be as usual classified into Group 10. These variations within the same strain were found in 10 plots. These phenomena acquired a new meaning for strain specificity, and will be designated as progression within the same strain⁵⁾.

On the other hand, plants subjected to 13.0 hours light in strain W1292 did not respond in plot XII, although plants subjected to other day lengths responded clearly in this plot. Responses of plants of the former can be newly classified into Group 9, although responses of plants of the latter can be classified as usual into Group 8. In strain W0623, plants subjected to 13.0 hours light did not respond in plot II, although plants subjected to other day lengths responded clearly in this plot. Responses of plants of the former can be classified into new Group, although the

responses of plants of the latter can be classified as usual into Group 4. These variations within the same strain were found in 6 plots. These phenomena also acquired a new meaning for strain specificity, and will be designated as regression within the same strain⁵⁾.

Succeeding to the previous paper, the following 3 items were reaffirmed. Group number classified by the responses obtained in some day length was shifted by the responses gotten in other day length. New group lacked in the responses obtained in some day length was significantly found by the responses gotten in other day length. Finally, these phenomena would be said as efficiencies in combinations by day length with accumulation treatment, and could be found by experiments without the aid of many species and/or strains.

2. Considering in connection with the data obtained previously⁵⁾ and the present experiments, the followings may be mentioned here. The strains of cultivated species, *O. sativa* and *O. glaberrima*, did not show any change as progression and regression in accordance with variation of day length. On the other hand, strains of *O. perennis* and *O. officinalis*, perennial wild species, showed some progression and regression in 2 day length, i.e., 11.0 and 13.0 hours light. In the present experiment, strains of *O. sativa* var. *spontanea*, annual wild species, did not show such change in some strain (W0598) although showed it in other strains (W0623 and W1235). In the previous paper, nearly the same results were obtained. This meant that the photoperiodic sensitivity of annual species in the genus *Oryza* in this sense was genetically in stable state, but that of perennial species was in unstable state. Moreover, these differences found in the stability seemed to have been mainly due to the evolutionary processes. So, it will be concluded that these phenomena were looked upon, more or less, as the universal validity for species or strain specificity and can be used as an index of photoperiodic sensitivity.

In strain W1294, the plants subjected to 11.0 hours light showed progressions in 2 plots, i.e., plots I and XVIII. Such 2

Fig. 1. Design of an experiment for studying accumulation effect. Solid and dotted lines indicate the periods during which a plant was subjected to short day conditions and natural day length, respectively.

Table 1. Heading dates of 80 and 85 days old plants of 12 strains treated with different day lengths and periods of short day treatment; heading dates of treated plants are expressed by the difference (in days) from those of the respective control plot, and heading dates of the control plots are expressed by the growing period (from sowing to heading)

Strain Control	W0039					W0623					W0027					W1294				
	11.0	11.5	12.0	12.5	13.0	11.0	11.5	12.0	12.5	13.0	11.0	11.5	12.0	12.5	13.0	11.0	11.5	12.0	12.5	13.0
Day length																				
I	15.6	13.6	14.0	13.3	11.7	11.3	11.0	10.3	10.0	9.0	0.0	0.3	0.3	0.0	0.0	3.7	2.0	1.7	1.3	1.3
II	10.3	10.7	9.0	8.0	8.3	10.3	10.3	9.0	9.0	1.3	1.0	1.0	0.7	1.0	0.0	2.0	1.7	0.3	1.0	1.0
III	1.3	1.3	1.0	0.0	0.3	7.0*	1.3	0.7	1.0	0.3	1.0	0.0	0.7	1.3	0.3	2.0	0.7	0.7	0.3	0.3
IV	1.0	0.3	0.3	0.7	0.0	0.3	0.3	0.7	0.7	0.0	1.0	0.3	0.3	0.0	0.0	1.7	0.3	1.0	0.7	0.3
V	25.3	24.0	21.7	23.3	21.7	12.3	12.3	11.7	12.0	11.3	14.0	14.0	14.0	12.3	10.7	22.7	22.0	20.3	21.7	2.0
VI	41.0	41.3	39.7	38.0	38.0	26.7	27.0	25.7	24.7	23.0	30.0	30.3	28.0	27.3	24.7	27.0	27.0	26.3	25.7	20.7
VII	24.0	21.3	22.0	21.7	18.7	12.0	10.7	11.0	10.7	9.7	1.3	0.7	0.7	0.3	0.7	2.3	1.7	2.0	1.3	0.7
VIII	1.0	0.7	1.0	0.3	1.0	1.0	1.0	0.3	0.3	0.7	1.3	1.0	1.7	0.0	0.7	2.3	2.0	1.7	0.3	0.7
IX	24.3	23.7	24.0	22.3	22.7	18.0	18.3	18.7	12.0	12.3	13.0	12.7	13.0	10.7	11.0	21.3	22.0	22.3	21.3	21.7
X	1.0	0.7	0.7	0.0	0.3	1.3	0.7	0.7	0.0	0.3	1.3	1.0	1.3	0.3	0.7	2.0	0.7	1.0	0.7	0.3
XI	15.0	16.0	14.7	13.3	12.0	11.3	11.7	10.3	9.4	9.0	1.3	0.7	1.3	1.0	0.7	2.0	2.0	1.3	0.0	0.7
XII	38.0	35.7	36.0	35.0	35.0	16.0	16.3	16.7	15.7	16.0	26.3	26.3	25.7	24.7	25.0	26.0	24.7	25.0	25.7	23.0
XIII	42.0	42.3	40.0	38.3	38.0	27.0	27.0	27.0	26.0	24.3	31.0	31.3	30.3	29.7	30.0	28.0	28.0	27.7	26.0	25.0
XIV	15.0	14.7	14.3	13.0	11.7	11.7	11.7	11.0	9.3	8.7	1.7	0.3	0.0	1.7	0.7	2.0	1.3	1.0	0.0	0.7
XV	25.0	23.0	23.0	23.7	22.3	14.7	13.0	13.0	13.4	9.7	14.0	12.7	13.3	13.3	6.7	22.0	21.7	22.0	21.7	2.3
XVI	14.7	10.3	8.0	8.3	8.3	11.7	9.7	9.7	9.0	6.7	0.7	0.3	1.0	1.0	0.7	1.7	1.7	1.7	1.7	1.7
XVII	31.0	30.7	30.7	29.3	25.0	16.0	15.0	15.3	15.0	11.0	17.0	16.7	17.0	16.0	9.3	24.7	26.7	25.7	24.3	20.0
XVIII	18.3	17.0	17.0	16.7	15.7	11.3	11.3	10.7	10.0	9.3	1.0	1.0	1.0	1.7	1.0	5.0	2.3	2.7	1.7	2.0
XIX	37.7	36.7	37.7	38.0	38.3	15.3	17.0	17.3	16.7	17.3	26.3	26.0	27.0	26.0	26.7	26.7	25.0	26.0	25.7	26.3
XX	35.0	35.3	34.0	34.7	33.0	15.0	15.0	15.0	14.0	13.7	24.7	23.3	22.7	21.3	19.7	24.7	24.7	24.0	25.0	22.7
5% l.s.d.	1.4					1.6					1.8					2.9				
Species	<i>O. glaberrima</i>					<i>O. sativa</i> var. <i>spontanea</i>					<i>O. glaberrima</i>					<i>O. perennis</i>				
Origin	Sierra Leone					Burma					Sierra Leone					Philippines				
Group**	4					4					5					5				

*: Numeral written in bold style means the plot in which response was clearly differing from those of the other day lengths.

**: It means the group number classified in the previous paper⁹.

Table 1. (Continued)

Strain Control	W0026 173.0						W0598 174.3						W1235 185.3						W1292 187.3					
Day length	11.0	11.5	12.0	12.5	13.0		11.0	11.5	12.0	12.5	13.0		11.0	11.5	12.0	12.5	13.0		11.0	11.5	12.0	12.5	13.0	
I	1.7	1.7	1.0	1.3	0.7		1.0	0.3	0.3	1.0	0.7		1.0	1.0	0.7	1.7	1.0		1.7	0.7	0.3	0.0	0.3	
II	1.7	0.3	0.7	1.3	0.3		0.7	0.3	0.0	0.7	1.0		1.0	0.3	0.0	1.3	0.7		1.7	0.7	0.3	0.7	0.0	
III	0.7	0.0	0.0	1.0	0.0		0.0	0.3	0.7	1.0	0.3		0.7	0.7	0.7	1.3	0.7		1.0	0.0	0.7	1.0	0.0	
IV	0.0	0.7	0.0	0.7	0.3		0.3	0.0	0.0	0.3	0.0		0.0	0.0	0.0	0.0	0.7		0.3	0.7	0.3	0.3	0.0	
V	2.0	1.7	1.7	1.7	1.0		1.0	0.7	0.7	1.0	0.3		1.0	0.7	1.0	0.3	0.7		1.7	1.0	1.0	0.3	1.0	
VI	36.0	37.0	36.3	36.0	34.7		24.0	22.0	22.3	22.7	22.7		28.7	29.0	28.3	28.0	25.0		30.0	27.7	27.7	28.0	25.7	
VII	0.7	0.7	0.3	1.3	1.0		0.7	0.3	0.0	0.0	0.7		1.0	0.0	0.3	1.0	0.3		0.7	1.0	1.0	1.0	0.7	
VIII	1.3	0.7	0.0	0.7	0.0		0.7	0.0	0.7	0.3	0.0		0.3	0.7	0.0	0.7	0.0		0.7	0.3	0.3	0.0	0.0	
IX	2.0	0.3	0.0	0.0	0.3		0.3	0.7	0.3	0.0	0.0		0.0	0.3	0.7	0.3	0.3		1.0	0.3	0.7	0.3	0.0	
X	1.7	0.0	0.0	0.3	0.3		1.0	0.0	0.7	0.0	0.3		1.7	1.7	0.7	0.3	0.7		1.3	0.7	1.0	0.3	0.3	
XI	1.7	1.3	0.7	1.3	1.0		0.3	0.7	0.3	0.3	0.0		1.0	0.7	1.0	1.0	1.3		1.0	0.0	0.0	1.7	0.7	
XII	33.0	30.7	31.3	31.0	28.0		23.3	23.7	23.0	22.0	18.0		22.0	22.0	22.3	21.0	21.0		20.7	21.0	20.7	21.3	1.0	
XIII	53.0	53.0	51.7	51.0	51.0		30.0	27.7	29.0	27.0	25.0		30.0	29.3	29.0	28.0	26.0		30.3	31.0	30.7	30.0	27.0	
XIV	2.0	0.7	0.7	0.7	0.7		1.0	0.3	1.0	1.0	0.3		1.7	1.7	0.3	0.3	0.0		0.3	0.7	0.3	1.0	0.7	
XV	2.0	0.0	0.3	1.7	1.0		22.0	22.0	22.3	21.7	8.7		5.0	0.7	1.3	0.3	0.0		4.6	0.0	0.7	0.3	0.0	
XVI	0.7	0.0	0.7	0.3	0.0		1.0	1.0	0.3	0.3	0.7		1.7	0.3	0.3	0.0	0.0		1.0	0.7	0.0	0.7	0.3	
XVII	22.0	19.7	20.0	21.0	20.0		1.0	1.0	0.0	0.0	0.3		6.3	0.3	1.0	1.0	0.3		1.7	1.0	1.0	0.3	0.3	
XVIII	2.0	0.7	1.7	0.0	0.3		0.0	1.0	0.0	0.0	0.0		0.3	0.7	1.0	1.7	0.7		0.3	0.0	1.0	0.0	0.3	
XIX	32.0	31.0	31.0	31.0	32.0		21.3	20.7	21.3	22.0	22.3		21.7	21.7	21.7	21.3	21.7		26.0	25.0	25.3	25.3	25.3	
XX	31.7	30.0	30.3	30.7	29.7		21.3	20.0	20.3	21.7	20.3		20.7	20.0	20.7	20.0	19.7		24.7	23.3	24.0	21.3	20.0	
5% l.s.d.	2.1						1.1						1.9						1.9					
Species	<i>O. glaberrima</i>						<i>O. sativa</i> var. <i>spontanea</i>						<i>O. sativa</i> var. <i>spontanea</i>						<i>O. perennis</i>					
Origin	Sierra Leone						Malaya						New Guinea						Kalimantan					
Group	6						7						8						8					

Table 1. (Continued)

Strain Control	W0612 184.3						C8515 175.0						W1269 185.3						W1282 186.7					
	11.0	11.5	12.0	12.5	13.0		11.0	11.5	12.0	12.5	13.0		11.0	11.5	12.0	12.5	13.0		11.0	11.5	12.0	12.5	13.0	
Day length	11.0	11.5	12.0	12.5	13.0		11.0	11.5	12.0 <td>12.5</td> <td>13.0</td> <td></td> <td>11.0</td> <td>11.5</td> <td>12.0<td>12.5</td><td>13.0</td><td></td><td>11.0</td><td>11.5</td><td>12.0<td>12.5</td><td>13.0</td></td></td>	12.5	13.0		11.0	11.5	12.0 <td>12.5</td> <td>13.0</td> <td></td> <td>11.0</td> <td>11.5</td> <td>12.0<td>12.5</td><td>13.0</td></td>	12.5	13.0		11.0	11.5	12.0 <td>12.5</td> <td>13.0</td>	12.5	13.0	
Plot	I	1.7	1.0	0.7	1.7	1.0	0.0	1.0	0.7	1.0	0.7		1.3	0.0	0.3	0.0	0.0		0.7	1.0	1.0	0.0	0.0	
	II	2.0	1.3	1.3	1.7	0.7	1.3	1.3	0.7	0.0	0.0		0.7	0.7	0.3	0.0	0.3		1.0	0.3	0.7	0.3	0.3	
	III	1.7	1.7	0.7	0.0	0.3	0.0	0.3	0.7	1.0	0.0		0.0	0.3	0.0	0.0	0.0		0.7	0.7	0.0	0.0	0.0	
	IV	1.7	0.7	0.0	0.7	0.7	1.0	0.0	0.3	0.7	0.0		0.3	0.0	0.0	0.0	0.7		0.3	0.0	1.0	0.0	0.7	
	V	2.0	1.0	1.7	0.0	0.7	1.0	0.3	0.7	0.0	0.0		1.0	1.3	1.0	0.3	0.0		0.0	0.3	0.0	0.0	0.0	
	VI	29.7	30.0	28.7	27.0	26.7	22.0	24.0	22.7	22.0	19.7		29.3	27.0	28.3	27.0	1.3		3.0	0.3	1.0	0.0	0.0	0.7
	VII	1.7	1.3	1.7	0.3	0.7	0.7	0.3	0.0	1.0	0.0		0.0	1.0	0.7	0.0	0.3		0.0	0.0	0.3	-0.3	0.0	
	VIII	1.7	2.0	0.7	0.7	0.7	0.7	1.3	0.0	1.3	0.3		0.0	0.7	0.7	0.0	0.7		0.0	0.7	0.0	0.0	0.0	
	IX	2.0	1.3	1.7	1.0	0.0	0.0	1.3	0.7	0.0	0.3		0.7	0.7	1.0	0.0	1.0		0.3	0.3	0.7	0.0	0.3	
	X	2.0	1.7	1.7	0.7	0.7	1.0	1.0	0.7	0.3	0.7		0.0	1.3	1.3	-0.3	0.3		1.0	1.0	0.3	0.0	0.0	
	XI	2.0	1.7	1.3	0.3	1.0	0.7	0.0	0.3	0.0	0.7		1.3	0.7	0.3	0.0	0.3		1.0	0.0	1.0	0.0	0.0	
	XII	8.3	2.7	2.0	2.7	1.0	1.0	0.0	0.3	1.0	1.0		0.0	1.0	1.3	0.0	0.7		0.7	0.0	0.3	0.0	0.3	
	XIII	30.0	30.0	28.7	27.3	27.0	23.0	24.3	23.0	22.7	21.0		30.0	29.7	29.7	27.3	21.0		3.0	0.7	1.0	0.3	0.3	
	XIV	2.0	2.0	2.0	2.0	2.0	1.0	0.7	0.0	1.3	0.0		1.3	1.0	1.0	-0.3	0.0		0.0	0.3	1.0	0.0	0.0	
	XV	0.0	1.0	0.3	1.0	0.3	0.7	1.0	0.7	1.0	0.3		0.3	0.0	0.3	0.3	0.0		0.3	0.0	0.0	-0.3	0.0	
	XVI	2.0	0.3	0.0	0.3	0.7	1.0	0.3	0.3	1.0	1.0		0.7	0.7	0.7	0.0	0.0		0.3	0.7	0.3	0.0	0.0	
	XVII	1.7	2.0	0.0	0.7	0.0	0.3	1.0	0.3	1.0	0.0		0.0	0.0	0.0	0.0	0.7		0.0	0.7	0.0	0.0	0.0	
	XVIII	2.3	1.7	2.0	2.3	1.7	1.3	0.7	0.3	0.7	0.3		0.0	0.3	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
	XIX	26.3	26.3	27.7	27.0	26.7	1.3	1.0	1.3	0.7	0.7		7.6	1.3	1.3	0.0	0.7		1.0	1.3	0.7	0.0	0.0	
	XX	25.0	25.3	21.7	20.3	2.3	1.3	1.0	1.0	0.3	1.0		1.7	1.0	1.7	0.0	0.3		1.0	0.7	0.7	0.0	0.3	
5% l.s.d.	2.9						1.5						1.8						1.4					
Species	<i>O. perennis</i>						<i>O. sativa</i>						<i>O. officinalis</i>						<i>O. officinalis</i>					
Origin	Brazil						Sarawak						Brunei						Sarawak					
Group	9						10						10						11					

progressions within the same day length were found in 3 cases in the total. On the other hand, 2 regressions within the same day length were found only in 1 case, *i.e.*, plot subjected to 13.0 hours light of strain W1294. These changes, progression and regression, within the same strain and the same day length were not found in the previous experiment, but recognized in the present experiment for the first time. Whether these phenomena may be attributable to the species or strain specificity could not make clear in the present informations.

3. The progressions were found only in 11.0 hours light and regressions were found only in 13.0 hours light. Those were not found exactly in 11.5, 12.0 and 12.5 hours light, so far as the previous⁵⁾ and the present experiments were concerned, so it was again concluded that the variations caused by combinations of day length with accumulation treatment may be found in plots where plants were subjected to day lengths shorter than 11.0 and longer than 13.0 hours lights. In other words, these phenomena could be seen as fundamental characters in the genus *Oryza*.

4. Accumulation effects in Groups 4 to 11 have been reported in the previous paper⁴⁾, in which the efficiencies and meanings of continuous and discontinuous short day conditions and of insertion of long day condition between the respective short day conditions were explained minutely. Then, meanings of 7 new groups mentioned in the chapter 1 should be only explained here. ① Plants of W0623 subjected to 13.0 hours light mean that insertions of 5 long day cycles (plot II) seem to be enough to eliminate completely the latent potentiality to floral induction, and those plants headed at nearly the same time with natural flowering. ② Plants of W1294 subjected to 11.0 hours light mean that continuous 15 short day cycles (plots I and XVIII) seem to be enough to induce the floral formation. ③ Plants of W1294 subjected to 13.0 hours light mean that insertion of 5 (plot V) and 10 (plot XV) long day cycles after the first short day cycles seem to be enough to

eliminate completely the latent potentiality to floral induction. ④ Plants of W1235 subjected to 11.0 hours light mean that 10 continuous (plot XV) and discontinuous (plot XVII) short day cycles after the long day insertions seem to be enough to induce the floral formation. ⑤ Plants of W0612 subjected to 13.0 hours light mean that 15 short day cycles after the long day insertion (plot XX) can not compensate the efficiency. ⑥ Plants of W1269 subjected to 11.0 hours light mean that continuous 20 short day cycles for 85 days old plants (plot XIX) seem to be enough to induce the floral formation. ⑦ Plants of W1269 subjected to 13.0 hours light mean that 5 long day cycles (plot VI) seem to be enough to eliminate completely the latent potentiality to floral induction, even if the second short day cycles were given for 20 times.

5. Aging effects could theoretically be examined by comparison of the data obtained in plots I with XVIII, in which the plants were subjected to continuous 15 days treatment, and in plots V with XX, in which the plants were subjected to discontinuous 20 days treatment.

The former case was slightly found in the whole strains and in the whole day lengths, especially in strain W0039. It was noteworthy that plants of W1294 subjected to 11.0 hours light responded in plots I and XVIII (② in the chapter 4), although plants subjected to other day lengths in both plants did not respond. It means combination effect of day length and accumulation effect.

The latter case was found in almost all the strains, especially strains belonging to Groups 6, 7, 8 and 9. In these groups, efficiencies were not found in plot V, but were found in plot XX, respectively. In Groups 4 and 5, efficiencies found in plot V were clearly smaller than those found in plot XX, and both of them were significantly larger in comparison with the data obtained in the respective control plot. In a strict sense, the following 2 cases were noticed. Plants of W1294 subjected to 13.0 hours light responded in plot XX but did not respond in plot V (③ in the chapter 4).

Plants of W0612 subjected to 13.0 hours light did not respond in plot XX (⑤ in the chapter 4). The former and the latter cases could be seen as “definiteness” and “bluntness” of aging effect, respectively.

As the plants in plots I and V, XVIII and XX, at the beginning were in 80 and 85 days old at the beginning of the treatment, respectively, differences of this plant age (=5 days) meant clearly the aging effect. Moreover, these aging effects were more or less changed in accordance with the change in day length.

6. The differences between the maximum and the minimum values within the same strain and within the same day length were calculated. It was ascertained, in general, that the shorter was the day length, the larger was the differences. These tendency was not clearly found in the differences between plots I and XVIII, and between plots V and XX, *i.e.*, aging effect.

7. The whole day length used here were shorter than the respective critical day lengths of the whole strains used²⁾. So, day lengths used here are said to be worth-while treatments.

Because the growing periods of some strains were very long not even in treated plots, their growth might have been affected to some extent by environmental conditions over the growing period. These problems, however, have not been fully studied, and remained to be investigated, and could not be solved only by uncomplicated experiment.

Summary

Succeeding to the previous papers, an experiment was conducted using 12 strains belonging to 5 species of the genus *Oryza* in order to investigate the changes of photoperiodic sensitivity with the insertion of long day conditions during short day condition and with the variations of day length. The results obtained were summarized as follows:

1. Accumulation effect of floral induction were tested by using natural day length and 100 plots, in which the plants were subjected to short day conditions, 11.0, 11.5, 12.0,

12.5 and 13.0 hours light and 13.0, 12.5, 12.0, 11.5 and 11.0 hours dark, respectively, having several combinations of short day and long day insertions. They were divided into 8 groups in regard to the behaviour found in the accumulation effect. Ten progressions and 6 regressions were found in 7 strains in accordance with the day length.

2. Species specificities were ascertained to some degree in progression and regression changes. Such variations were steady found in only 11.0 and 13.0 hours light, then it was concluded that these phenomena could be seen as fundamental characters in the genus *Oryza*.

3. According to these variations, changes of the group number were recognized in 5 cases and 7 new groups were detected in the present experiment.

4. Aging effects were recognized in a certain limit, and some “definiteness” and “bluntness” were found within the same strain and within the same day length.

5. It was reaffirmed that the pattern in the respective day length and in combinations with short and long day insertions were clearly different among various species and strains, and that the behaviour can be used as an index of accumulation effect, *i.e.*, photoperiodic sensitivity, in the genus *Oryza*.

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〔和 文 摘 要〕

稲 属 の 感 光 性

第10報 苗 齢 ・ 日 長 ・ 累 積 効 果 の 組 合 せ (2)

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稲属5種12系統を用いて自然日長区および短日処理100区を設け、80日齢と85日齢に達した時、11.0, 11.5, 12.0, 12.5および13.0時間明期の短日処理を開始した。処理期間中に種々の程度の自然日長条件を挿入した。これにより苗齢・日長・短日条件累積効果の組合せ結果に関して調査を行った。

反応に従ってまず8群に分類された。同一系統内である明期にのみ感応が認められる進行現象が10例、ある明期にのみ感応が認められなくなる退行現象が6例みられた。前者は11.0明期にのみ、後者は13.0明期にのみ認められた。両者の発現にある程度の種特異性が認められ、前報の結果を考え合せると、これらの現象は稲属に安定した形質とみなし得るものと思われる。

苗齢効果はかなり確認され、またある明期において特異的に“明確化”または“鈍化”する現象がみられた。