[Research Note]

Heading Performance of Rice Varieties under Double Cropping on Ishigaki Island

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Abstract

In order to advance generations of hybrid populations of rice effectively, the heading performance of several varieties in the first and second cropping seasons on Ishigaki island was investigated, and heading dates of the varieties in both Ishigaki and in mainland Japan (Tsukuba city, Ibaraki prefecture) were compared. Number of days to heading in the second cropping season was less than in the first season for all the varieties used. The Japonica group showed a larger variation in heading performance than the Indica group, except for the strongly photoperiod-sensitive varieties, in the first and second seasons. The temperate type Japonica varieties headed earlier than the varieties of the Indica group and the tropical type Japonica. Most varieties of the Indica group and the tropical type Japonica were late maturing in Ishigaki and Tsukuba. Number of days to heading of many Japonica varieties in Ishigaki became less than in Tsukuba except for the tropical type.

Additional key words: rapid generation advancement, Indica, Japonica

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Introduction

Rapid generation advancement of the early generations of hybrid populations is essential in crop breeding[1] and many rice varieties released recently have been subjected to the procedure.

Most rice breeding laboratories are advancing early generations of hybrid populations using greenhouses[5, 8, 11], and some are utilizing paddy fields which are located in the southern part of Kyushu island or the subtropical islands of Okinawa prefecture[4].

Okinawa Subtropical Station of Japan International Research Center for Agricultural Sciences (JIRCAS, former Okinawa Branch of Tropical Agriculture Research Center) has initiated a program for the rapid generation advancement for hybrid populations of rice on Ishigaki island since 1981[4]. Recently, not only Japanese varieties but many foreign varieties have been used as parents. In order to advance generations of hybrid populations effectively, it is important to investigate the heading performance of parental varieties beforehand.

Heading characteristics of distinctive Japanese varieties from Hokkaido to Kyushu and strongly photoperiod-sensitive varieties such as Aman which is one of the agricultural ecotypes cultivated in India, were already clarified on Ishigaki island[3, 9].

Double cropping of rice is widely practiced on the island, and day length and temperature conditions in the first and second seasons are different[4, 9]. The heading performance of tropical type Indica varieties such as Boro and Aus in India, the temperate type Indica varieties such as Chinese Hsien and the tropical type Japonica varieties such as those of the Javanica group has not been investigated under cultivation in Ishigaki except for a few varieties[2, 3]. The present paper reports on the heading performance of several rice varieties in the first and second seasons on Ishigaki island and a comparison between the heading performance of the varieties on the island and that at Tsukuba city, Ibaraki prefecture is also presented.

Materials and Methods

A total of 139 rice varieties consisting of 77 indigenous and 62 improved varieties from various countries were used. They were classified into 55 varieties of the Indica and 84 of the Japonica varietal groups based on morphological observations[7] and esterase isozyme analysis[10]. Out of the Indica group, 26 belonged to the tropical type Indica and the remaining 29 to the temperate type Indica. Since the heading performance of the strongly photoperiod-sensitive varieties in the varietal group (for example, Aman in India) had already been clarified in Ishigaki, those were excluded in the present experiments. Out of the Japonica group, 52 belonged to the temperate type Japonica (originating from Japan, Korea and North China, etc.) and the remaining 32 belonged to the tropical type Japonica (from the Philippines, Indonesia and other southeastern Asian countries). Variety name, varietal group and their origin are listed in the Appendix.

Differences in heading date of rice varieties in the first and second seasons were investigated at the Okinawa Subtropical Station of JIRCAS on Ishigaki island, Okinawa prefecture in 1992. Sowing dates for the first and second cropping seasons were February 21 and July 17, respectively. Seedlings were raised in seedling boxes and transplanted on March 12 and August 3 in the first and second seasons, respectively, with a single plant per hill. Number of days for raising seedlings was 19 days in the first season and 16 in the second. The amounts of basal-dressing and top-dressing at tillering stage were 0.3 and 0.2Nkg/a, respectively.

In order to compare the heading performance of rice varieties between Ishigaki and mainland Japan, the same varieties were grown on Ishigaki island (North latitude : 24° 20', East longitude: 124° 10') and at the National Institute of Agrobiological Resources at Tsukuba (North latitude: 36° 1', East longitude: 140° 6') in 1991. Sowing dates were May 23 in Ishigaki and May 9 in Tsukuba and seedlings were raised using seedling boxes. The seedlings

were transplanted on June 17 in Ishigaki and June 12 in Tsukuba. Heading date of the varieties was recorded in both locations.

Results and Discussion

Differences in heading performance of several varieties in the first and second seasons

The earliest variety in the first season was the Japanese variety, Hokuto, which headed on April 20, while the latest one, Padi Kenikir Puti headed on June 19 (Appendix). Number of days to heading was 59 and 119 days, respectively (Table 1). In the second season Hokuto headed on September 5, and was again the earliest among the varieties used. The latest variety in the season was Masumikir, which headed on October 27 (Appendix). Number of days to heading of these two varieties in the second season was 50 and 102 days (Table 1).

A highly positive correlation (r=0.919) was observed between the number of days to heading in the first and second seasons (Fig. 1), though the number of days to heading in the second season was less than that in the first season for all the materials. Araki & Ikehashi (1984) reported that there was a high correlation (r=0.851) between the heading dates of nine varieties (one Japonica and eight Indica varieties) in the first and second seasons in Ishigaki, too[3].

Heading performance between the varieties in the Indica and Japonica groups was compared. The heading date in the Indica group ranged from May 8 (the earliest variety) to June 14 (the latest) in the first season and that of the Japonica group from April 20 to June 19. The difference between the earliest variety and the latest one was 38 days in the Indica group and 61 days in the Japonica in the first season (Table 1). The Japonica group exhibited a larger variation in heading date than the Indica group. In the second season, heading in the Indica group occurred from September 19 to October 16 while in the Japonica group from September 5 to October 27. The Japonica group showed a larger variation in heading date than the Indica group in the second season, too. The varieties with a strong photoperiod-sensitivity headed from November to December on Ishigaki island regardless of the sowing dates[9]. Since the strongly photoperiod-sensitive varieties were excluded in the Indica group in the present experiments, this group showed a narrow range of heading date. However, there were very few early maturing varieties in the group. Therefore, most of the hybrid populations derived from crosses using the Indica varieties were expected to head late. At present, in the hybrid populations from the crosses using very early or early maturing parental varieties three generations per year could be efficiently accelerated under field conditions on Ishigaki island, while for the Indica group acceleration of a maximum of two generations per year could be achieved.

Heading performance of the varieties was compared among four varietal groups; the tropical type Indica, the temperate type Indica, the tropical type Japonica and the temperate type Japonica groups.

Heading date of the tropical type Indica varied from May 8 to June 9 in the first season, and from Septembr 19 to October 12 in the second season. The ranges of heading date in the first and second seasons were 33 and 24 days, respectively, showing a small variation in heading characteristics in the four groups.

The heading date in the temperate type Indica varied from May 11 to June 14 in the first season and from September 23 to October 16 in the second season, the former heading earlier than the tropical type Indica group. As the decrease of number of days to heading in this type was less pronounced than that of the temperate type Japonica, this type seems to have a longer basic vegetative growth period.

The tropical type Japonica headed from May 12 to June 19 in the first season and from September 15 to October 27 in the second. Varieties of this type exhibited a wide range of heading characteristics and most of them were late maturing in both cropping seasons because of their

Table 1. Heading characteristics of several rice varieties under double cropping on Ishigaki island

March transplanting (days 59–88)

Varietal group	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
Heading date	<April> 20	21	22	23	24	25	26	27	28	29	30	<May> 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Trop. Indica																			1		2	1			1				3	3
Temp. Indica																						1				2	1	1		4
Trop. Japonica																							1		2	1			1	2
Temp. Japonica	1									1					4	2	10	6	2	3	2	7	2			2	2	2	1	3
Indica																			1		2	2			1	2	1	1	3	7
Japonica	1									1					4	2	10	6	2	3	2	7	3		2	3	2	2	2	5

March transplanting (days 89–119)

Varietal group	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	Range Earliest- Latest	(Days)	Number of varieties
Heading date	20	21	22	23	24	25	26	27	28	29	30	31	<June> 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19			
Trop. Indica	1		2		2	1			4	2			2								1											May 8 - Jun. 9	33	26
Temp. Indica	1		1			1	2				3	2	1	1	1		1	1	3	1						1						May.11 - Jun. 14	35	29
Trop. Japonica	1	1	2		1	2					1	4	2	2	2		2				1			2						1	1	May.12 - Jun. 19	39	32
Temp. Japonica									1		1																					Apr. 20 - May 30	41	52
Indica	2		3		2	2	2		4	2	3	2	3	1	1		1	1	3	1	1					1						May 8 - Jun. 14	38	55
Japonica	1	1	2		1	2			1		2	4	2	2	2		2				1			2						1	1	Apr. 20 - Jun. 19	61	84

August transplanting (days 50–75)

Varietal group	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Heading date	<September> 5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Trop. Indica															1					2	4	2	3	1	1	
Temp. Indica																			1		3		1	2	3	1
Trop. Japonica											1				1			2	1	1	1		1	2	2	1
Temp. Japonica	1							1	2	5	13	5	3	2	7	2	2	4	3					1		
Indica															1				1	2	7	2	4	3	4	1
Japonica	1							1	2	5	14	5	3	2	8	2	2	6	4	1	1		1	3	2	1

August transplanting (days 76–102)

Varietal group	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	Range Earliest- Latest	(Days)	Number of varieties
Heading date	<October> 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
Trop. Indica	4		2	4	1							1																Sep. 19 - Oct. 12	24	26
Temp. Indica	1	1	3	2	3			1	2	2	1					2												Sep. 23 - Oct. 16	24	29
Trop. Japonica	2	3		4		1	2				1				3							1		1			1	Sep. 15 - Oct. 27	43	32
Temp. Japonica				1																								Sep. 5 - Oct. 4	30	52
Indica	5	1	5	6	4			1	2	2	1	1				2												Sep. 19 - Oct. 16	29	55
Japonica	2	3		5		1	2				1				3							1		1			1	Sep. 5 - Oct. 27	53	84

Numerals indicate the number of varieties.

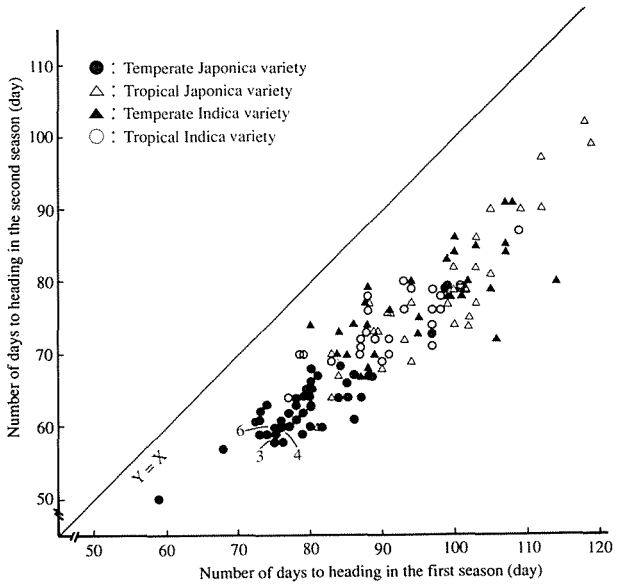

Fig. 1 Relationship between number of days to heading in the first and second seasons on Ishigaki island.

long basic vegetative growth[6, 7]. Therefore, the tropical type Japonica varieties used in the present experiments were characterized by a weak photoperiod-sensitivity and a long basic vegetative growth period. The earliest varieties in both cropping seasons belonged to the temperate type Japonica, and there were many early maturing varieties in the same group. As the number of days to heading was reduced in the second season, this type seems to have a shorter basic vegetative growth period than the varieties of the other types. In this group Kahei and Taichung 65 headed very late, in contrast to other varieties. Judging from their heading characteristics, these two varieties seem to belonged to the tropical type Japonica.

The heading performance of several rice varieties and varietal groups in the first and second cropping seasons in Ishigaki was clarified and the data obtained should provide useful information for efficient rapid generation advancement.

Comparison of heading performance of rice varieties between Ishigaki and Tsukuba

Since the sowing and transplanting dates in the present experiments were slightly different between Ishigaki and Tsukuba, a precise comparison of the date could not be made. However natural day length conditions in Ishigaki and Tsukuba are completely different (Table 2), for example the shortest day length in the summer solstice is 13 hours and 39 minutes in Ishigaki and 14 hours 37 minutes in Tsukuba. Furthermore, since the temperature conditions are also different between the two locations (Table 2), we considered that it is possible to determine the difference in heading characteristics between the varieties based on the present results as a general trend.

As shown in Fig. 2, a significantly positive correlation (r=0.740) was observed between heading dates of the Indica group grown in Ishigaki and those in Tsukuba. As most varieties showed a distribution of heading dates, Y=X, these varieties may not head earlier even in Ishigaki because of the longer basic vegetative growth. For example, IR24 required 97 and 108 days to head in Ishigaki and Tsukuba, respectively.

For the Japonica group a significantly positive correlation (r=0.702) was also observed between the heading dates in Ishigaki and in Tsukuba (Fig. 2). As most varieties showed a distribution below a linear line, Y=X, many Japonica varieties in Ishigaki headed earlier than in Tsukuba. Particularly Shiranui, Nishihomare and Reiho, varieties which were released for Kyushu island, headed earlier than other Japanese varieties because of the shorter basic vegetative growth period[12].

However, the tropical type Japonica varieties, for examle, Padi Kenikir Puti and Masumikir, did not head earlier due to their longer basic vegetative growth period[6, 7, 12]. In most of the Japonica varieties except for the tropical type the growth duration could be shortened in Ishigaki. A higher correlation of r=0.950 was reported between heading dates in the first season in Ishigaki and in Tsukuba, and also r=0.934 between heading dates in the second season in Ishigaki and in Tsukuba, using nine varieties[3]. It was concluded that selection for earliness could be roughly achieved in Ishigaki. Judging from the present results, however, since the correlation coefficient was not very high in the Japonica group (r=0.702), it may be difficult to select plants having a relatively

Table 2. Temperature and day length in Ishigaki and Tsukuba

Location	Temperature	Jan.	Fed.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Ishigaki	Max. (°C)	21.6	20.6	24.5	26.0	28.7	31.7	32.4	32.3	30.5	27.5	24.5	23.4
	Mean (°C)	19.2	18.3	22.1	23.5	26.3	29.3	30.0	29.5	28.1	25.0	22.2	20.6
	Min (°C)	17.3	16.3	20.1	21.4	24.4	27.5	28.1	27.5	25.9	23.2	20.5	18.2
Tsukuba	Max (°C)	9.2	10.1	12.9	18.6	22.1	26.3	29.3	28.2	26.2	20.1	15.5	11.4
	Mean (°C)	3.2	4.0	7.7	13.6	17.0	22.1	24.6	23.8	22.3	16.6	10.2	6.2
	Min (°C)	-2.2	-1.8	3.0	9.3	12.2	18.6	21.2	20.7	19.4	13.3	5.5	1.1

Location	Day length (hr. min.)	Jan.	Fed.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Ishigaki		10.49	11.22	12.02	12.44	13.19	13.37	13.29	12.58	12.18	11.36	10.58	10.40
Tsukuba		11.13	12.00	12.58	14.07	15.14	15.49	15.31	14.37	13.30	12.24	11.29	11.00

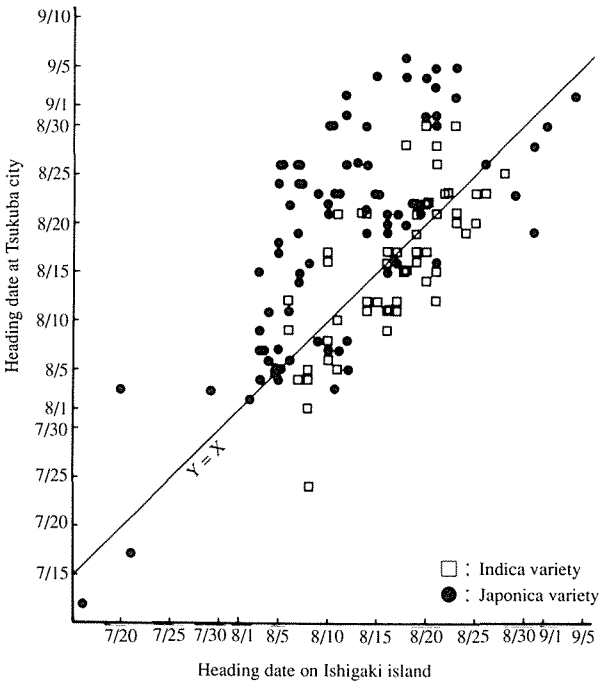

Fig. 2. Relationship between heading date on Ishigaki island and Tsukuba city.

strong photoperiod-sensitivity and a short basic vegetative growth period, particularly for the temperate type Japonica.

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Appendix Heading date of rice varieties in Ishigaki and Tsukuba

No.	Variety name		Varietal group	Origin	Heading date			
					Ishigaki Ⅰ	Ishigaki Ⅱ	Ishigaki Ⅲ	Tsukuba
1	Ma Sho		Trop. Indica	Burma	Jun. 1	Aug. 21	Oct. 4	Aug. 26
2	Muha		Trop. Indica	India	May 19	Aug. 21	Oct. 1	Aug. 21
3	Dakanalo		Trop. Indica	India	May 8	Aug. 11	Sep. 19	Aug. 21
4	Surjamkhi		Trop. Indica	India	May 19	Aug. 18	Sep. 28	Aug. 15
5	Dular		Trop. Indica	India	May 10	Aug. 7	Sep. 25	Aug. 4
6	Pusur		Trop. Indica	India	May 11	Aug. 11	Sep. 24	Aug. 5
7	T246		Trop. Indica	India	May 10	Aug. 10	Sep. 25	Aug. 6
8	Chinsurah Boro 2		Trop. Indica	India	May 29	Aug. 21	Oct. 3	Aug. 15
9	Jhona 2		Trop. Indica	India	May 14	Aug. 21	Sep. 24	Aug. 28
10	Co 13		Trop. Indica	India	May 22	Aug. 26	Sep. 27	Aug. 23
11	Nepal 1		Trop. Indica	Nepal	May 25	Aug. 16	Oct. 4	Aug. 11
12	Nepal 8		Trop. Indica	Nepal	May 19	Aug. 14	Oct. 3	Aug. 11
13	Nepal 18		Trop. Indica	Nepal	May 28	Aug. 17	Oct. 4	Aug. 12
14	Nepal 555		Trop. Indica	Nepal	May 24	Aug. 24	Oct. 5	Aug. 19
15	Kinandang Puti		Trop. Indica	Philippines	May 18	Aug. 16	Sep. 26	Aug. 9
16	Jaguary		Trop. Indica	Brazil	Jun. 1	Aug. 16	Oct. 4	Aug. 16
17	Milyang 23	密陽23号	Trop. Indica	Korea	May 28	Aug. 19	Sep. 26	Aug. 19
18	Suweon 258	水原258号	Trop. Indica	Korea	May 29	Aug. 23	Oct. 1	Aug. 30
19	Tongil	統一	Trop. Indica	Korea	May 28	Aug. 14	Sep. 29	Aug. 21
20	Habataki	ハバタキ	Trop. Indica	Japan	May 18	Aug. 6	Sep. 27	Aug. 9
21	Sari-kuin	ｻﾘｰｸｲｰﾝ	Trop. Indica	Japan	May 22	Aug. 18	Sep. 25	Aug. 15
22	IR24		Trop. Indica	IRRI	Jun. 9	Aug. 28	Oct. 12	Aug. 25
23	IR28		Trop. Indica	IRRI	May 28	Aug. 17	Oct. 1	Aug. 17
24	IR29		Trop. Indica	IRRI	May 24	Aug. 20	Oct. 1	Aug. 14
25	IR30		Trop. Indica	IRRI	May 20	Aug. 20	Sep. 27	Aug. 17
26	IR2061-214-3		Trop. Indica	IRRI	May 18	Aug. 18	Sep. 25	Aug. 28
27	Xuanchangmi	宣昌米	Temp. Indica	China	May 17	Aug. 10	Sep. 29	Aug. 8
28	Liuzhoubaoyazao	柳州包芽早	Temp. Indica	China	May 19	Aug. 8	Oct. 2	Aug. 5
29	Xiligu	細粒穀	Temp. Indica	China	May 20	Aug. 5	Sep. 25	Aug. 5
30	Aijiaonante	矮脚南特	Temp. Indica	China	May 26	Aug. 10	Sep. 28	Aug. 16
31	Hongmi	紅米	Temp. Indica	China	May 30	Aug. 10	Oct. 3	Aug. 17
32	Chixiandao	遅秈稲	Temp. Indica	China	May 15	Aug. 11	Sep. 25	Aug. 10
33	Hongxienuo	紅血糯	Temp. Indica	China	May 22	Aug. 17	Oct. 1	Aug. 11
34	Hunanxian	湖南秈	Temp. Indica	China	Jun. 3	Aug. 19	Oct. 10	Aug. 17
35	Deegeowoogen	低脚烏尖	Temp. Indica	China	Jun. 7	Aug. 22	Oct. 10	Aug. 23
36	Daorenqiao	道人橋	Temp. Indica	China	Jun. 5	Aug. 22	Oct. 4	Aug. 23
37	Duanguanhualuo	短広花螺	Temp. Indica	China	Jun. 8	Aug. 23	Oct. 16	Aug. 20
38	Zhamianni	扎緬尼	Temp. Indica	China	Jun. 7	Aug. 25	Oct. 16	Aug. 20
39	Hongcjeuhzhai		Temp. Indica	China	May 26	Aug. 8	Sep. 30	Aug. 4
40	Qingyu	清油	Temp. Indica	China	May 31	Aug. 19	Oct. 9	Aug. 16
41	Wuguhualuo	烏穀花螺	Temp. Indica	China	May 31	Aug. 16	Oct. 11	Aug. 17
42	Deejiaohualuo	低脚花螺	Temp. Indica	China	May 30	Aug. 15	Oct. 8	Aug. 12
43	Dengpaozhai	等抛斉	Temp. Indica	China	Jun. 6	Aug. 20	Sep. 27	Aug. 22
44	Toboshi	唐干	Temp. Indica	Japan	May 19	Aug. 14	Sep. 23	Aug. 21
45	Tadukan		Temp. Indica	Philippines	Jun. 14	Aug. 20	Oct. 5	Aug. 30
46	Guangluai 4	広陸矮4号	Temp. Indica	China	May 11	Aug. 8	Sep. 29	Jul. 24
47	Nanjing 11	南京11号	Temp. Indica	China	May 19	Aug. 6	Sep. 29	Aug. 12
48	Juanyebai	巻葉白	Temp. Indica	China	May 16	Aug. 8	Sep. 25	Aug. 1
49	China 830		Temp. Indica	China	May 15	Aug. 14	Sep. 28	Aug. 12
50	Zhaiyeqing 8	窄葉青8号	Temp. Indica	China	May 19	Aug. 16	Oct. 4	Aug. 11

(cont.)

No.	Variety name		Varietal group	Origin	Heading date			
					Ishigaki Ⅰ	Ishigaki Ⅱ	Ishigaki Ⅲ	Tsukuba
51	Guizhao 2	桂朝2号	Temp. Indica	China	Jun. 2	Aug. 23	Oct. 5	Aug. 21
52	Dianyu 1	滇榆1号	Temp. Indica	China	May 25	Aug. 21	Oct. 5	Aug. 12
53	Taichungxian 3	台中仙1号	Temp. Indica	Taiwan	Jun. 7	Aug. 25	Oct. 9	Aug. 23
54	Taichungyu 204	台中育204号	Temp. Indica	Taiwan	May 30	Aug. 19	Oct. 3	Aug. 21
55	Taichungzailai 1	台中在来1号	Temp. Indica	Taiwan	Jun. 1	Aug. 20	Oct. 3	Aug. 22
56	Nanjingxiangdao	南京香稲	Trop. Japonica	China	May 19	Aug. 14	Sep. 28	Aug. 19
57	Naxi	納西	Trop. Japonica	China	May 14	Aug. 11	Sep. 19	Aug. 23
58	Bayuenuo	八月糯	Trop. Japonica	China	May 18	Aug. 5	Sep. 22	Aug. 26
59	In Sitt		Trop. Japonica	Burma	May 31	Aug. 14	Sep. 29	Aug. 21
60	Khauk Yoe		Trop. Japonica	Burma	Jun. 3	Aug. 15	Oct. 7	Aug. 23
61	Mack Kheua		Trop. Japonica	Laos	May 31	Aug. 21	Oct. 4	Sep. 3
62	Khao Nok		Trop. Japonica	Laos	May 31	Aug. 20	Oct. 4	Aug. 31
63	Deng Mack Tek		Trop. Japonica	Laos	Jun. 1	Aug. 18	Oct. 4	Sep. 4
64	Dam Ngo		Trop. Japonica	Laos	Jun. 1	Aug. 20	Oct. 4	Sep. 4
65	Lep Xang		Trop. Japonica	Laos	May 24	Aug. 21	Sep. 27	Sep. 16
66	Daw Dam		Trop. Japonica	Laos	May 22	Aug. 15	Oct. 1	Sep. 4
67	Canabongbong		Trop. Japonica	Philippines	Jun. 3	Aug. 19	Oct. 11	Aug. 21
68	Simedel		Trop. Japonica	Indonesia	May 31	Aug. 17	Oct. 7	Aug. 21
69	Siampang		Trop. Japonica	Indonesia	Jun. 5	Aug. 26	Oct. 15	Aug. 26
70	Ladang		Trop. Japonica	Indonesia	Jun. 12	Sep. 4	Oct. 22	Sep. 2
71	Simanoek		Trop. Japonica	Indonesia	May 30	Aug. 16	Oct. 2	Aug. 20
72	Bodat Mayang		Trop. Japonica	Indonesia	Jun. 2	Aug. 15	Sep. 30	Aug. 23
73	Masumikir		Trop. Japonica	Indonesia	Jun. 18	Aug. 31	Oct. 27	Aug. 28
74	Padi Kenikir Puti		Trop. Japonica	Indonesia	Jun. 19	Sep. 1	Oct. 24	Aug. 30
75	Geraldine		Trop. Japonica	Brazil	May 25	Aug. 16	Oct. 2	Aug. 19
76	Afgha WYR-5088		Trop. Japonica	Russia	May 19	Aug. 31	Oct. 2	Aug. 19
77	Shwe War		Trop. Japonica	Burma	Jun. 5	Aug. 18	Oct. 6	Sep. 6
78	KU 70-1		Trop. Japonica	Thailand	May 15	Aug. 14	Sep. 22	Aug. 26
79	Dinalaga		Trop. Japonica	Phlippines	May 25	Aug. 10	Sep. 24	Aug. 21
80	Vista		Trop. Japonica	USA	May 21	Aug. 6	Sep. 23	Aug. 11
81	North Rose		Trop. Japonica	USA	May 14	Aug. 7	Sep. 25	Aug. 15
82	Labelle		Trop. Japonica	USA	May 20	Aug. 18	Sep. 28	Aug. 20
83	Texas Fortuna		Trop. Japonica	USA	Jun. 2	Aug. 16	Sep. 29	Aug. 21
84	CS-S4		Trop. Japonica	USA	May 12	Aug. 7	Sep. 15	Aug. 24
85	Tambo		Trop. Japonica	Brazil	Jun. 9	Aug. 29	Oct. 15	Aug. 23
86	Dourado Precoce		Trop. Japonica	Brazil	May 22	Aug. 16	Oct. 1	Aug. 15
87	Moroberekan		Trop. Japonica	Liberia	Jun. 12	Aug. 23	Oct. 15	Sep. 2
88	Asahi	旭	Temp. Japonica	Japan	May 18	Aug. 21	Sep. 19	Aug. 31
89	Akage	赤毛	Temp. Japonica	Japan	May 6	Aug. 2	Sep. 14	Aug. 2
90	Shirakawa	白川	Temp. Japonica	Japan	May 12	Aug. 4	Sep. 22	Aug. 6
91	Shinshu-kaneko	信州金子	Temp. Japonica	Japan	May 9	Aug. 10	Sep. 16	Aug. 7
92	Shinshu	信州	Temp. Japonica	Japan	May 9	Aug. 11	Sep. 18	Aug. 7
93	Oba	大場	Temp. Japonica	Japan	May 6	Aug. 8	Sep. 13	Aug. 16
94	Sekiyama	関山	Temp. Japonica	Japan	May 7	Aug. 5	Sep. 13	Aug. 17
95	Kahei	嘉平	Temp. Japonica	Japan	May 28	Aug. 17	Sep. 28	Aug. 16
96	Kokuryoumiyako	穀良都	Temp. Japonica	Japan	May 6	Aug. 7	Sep. 15	Aug. 24
97	Tamanishiki	玉錦	Temp. Japonica	Japan	May 7	Aug. 5	Sep. 15	Aug. 24
98	Jikkoku	十石	Temp. Japonica	Japan	May 6	Aug. 9	Sep. 15	Aug. 23
99	Ginbozu	銀坊主	Temp. Japonica	Japan	May 11	Aug. 12	Sep. 23	Aug. 8
100	Banzai	万才	Temp. Japonica	Japan	May 6	Aug. 10	Sep. 15	Aug. 30

(cont.)

No.	Variety name		Varietal group	Origin	Heading date			
					Ishigaki Ⅰ	Ishigaki Ⅱ	Ishigaki Ⅲ	Tsukuba
101	Kameji	亀治	Temp. Japonica	Japan	May 4	Aug. 10	Sep. 16	Aug. 30
102	Shinriki	神力	Temp. Japonica	Japan	May 11	Aug. 21	Sep. 19	Sep. 5
103	Kogyoku	黄玉	Temp. Japonica	Japan	May 15	Aug. 23	Sep. 19	Sep. 5
104	Damattero	ﾀﾞﾏｯﾃﾛ	Temp. Japonica	Japan	May 16	Aug. 4	Sep. 21	Aug. 11
105	Huanggu	黄穀	Temp. Japonica	China	May 7	Aug. 6	Sep. 15	Aug. 22
106	North China 16	北支16号	Temp. Japonica	China	May 19	Aug. 19	Sep. 22	Aug. 22
107	Lizihong	李子紅	Temp. Japonica	China	May 16	Aug. 11	Sep. 19	Aug. 23
108	Sinaba		Temp. Japonica	Philippines	May 19	Aug. 7	Sep. 23	Aug. 19
109	Norin 1	農林1号	Temp. Japonica	Japan	May 11	Aug. 11	Sep. 21	Aug. 3
110	Norin 8	農林8号	Temp. Japonica	Japan	May 7	Aug. 5	Sep. 15	Aug. 26
111	Norin 29	農林29号	Temp. Japonica	Japan	May 6	Aug. 7	Sep. 14	Aug. 26
112	Fujisaka 5	藤坂5号	Temp. Japonica	Japan	May 8	Aug. 5	Sep. 15	Aug. 5
113	Hokuto	北斗	Temp. Japonica	Japan	Apr. 20	Jul. 16	Sep. 5	Jul. 12
114	Kitahikari	ｷﾀﾋｶﾘ	Temp. Japonica	Japan	Apr. 29	Jul. 21	Sep. 12	Jul. 17
115	Todorokiwase	ﾄﾄﾞﾛｷﾜｾ	Temp. Japonica	Japan	May 15	Aug. 12	Sep. 23	Aug. 5
116	Sasanishiki	ｻｻﾆｼｷ	Temp. Japonica	Japan	May 11	Aug. 5	Sep. 20	Aug. 5
117	Reimei	ﾚｲﾒｲ	Temp. Japonica	Japan	May 7	Aug. 5	Sep. 16	Aug. 5
118	Kinmaze	金南風	Temp. Japonica	Japan	May 17	Aug. 12	Sep. 16	Aug. 26
119	Akihikari	ｱｷﾋｶﾘ	Temp. Japonica	Japan	May 6	Aug. 5	Sep. 14	Aug. 4
120	Toyonishiki	ﾄﾖﾆｼｷ	Temp. Japonica	Japan	May 10	Aug. 5	Sep. 17	Aug. 7
121	Honenwase	ﾎｳﾈﾝﾜｾ	Temp. Japonica	Japan	May 9	Aug. 6	Sep. 19	Aug. 6
122	Kinuhikari	ｷﾇﾋｶﾘ	Temp. Japonica	Japan	May 4	Aug. 3	Sep. 16	Aug. 9
123	Koshihikari	ｺｼﾋｶﾘ	Temp. Japonica	Japan	May 5	Aug. 3	Sep. 18	Aug. 15
124	Kochihibiki	ｺﾁﾋﾋﾞｷ	Temp. Japonica	Japan	May 5	Aug. 5	Sep. 14	Aug. 18
125	Nipponbare	日本晴	Temp. Japonica	Japan	May 4	Aug. 10	Sep. 14	Aug. 22
126	Koganemasari	ｺｶﾞﾈﾏｻﾘ	Temp. Japonica	Japan	May 7	Aug. 7	Sep. 15	Aug. 26
127	Nakateshinsenbon	中生新千本	Temp. Japonica	Japan	May 11	Aug. 13	Sep. 15	Aug. 26
128	Reiho	ﾚｲﾎｳ	Temp. Japonica	Japan	May 12	Aug. 14	Sep. 15	Aug. 30
129	Nishihomare	ﾆｼﾎﾏﾚ	Temp. Japonica	Japan	May 6	Aug. 12	Sep. 15	Aug. 31
130	Shiranui	ｼﾗﾇｲ	Temp. Japonica	Japan	May 8	Aug. 12	Sep. 17	Sep. 2
131	Hoshiyutaka	ﾎｼﾕﾀｶ	Temp. Japonica	Japan	May 19	Aug. 21	Sep. 22	Aug. 30
132	Ochikara	ｵｵﾁｶﾗ	Temp. Japonica	Japan	May 17	Aug. 7	Sep. 22	Aug. 14
133	Owarihatamochi	ｵﾜﾘﾊﾀﾓﾁ	Temp. Japonica	Japan	May 10	Aug. 3	Sep. 19	Aug. 7
134	Hokurikumochi 141	北陸糯141号	Temp. Japonica	Japan	May 11	Aug. 9	Sep. 20	Aug. 8
135	Taichung 65	台中65号	Temp. Japonica	Taiwan	May 30	Aug. 19	Oct. 4	Aug. 21
136	Wzbeuskij 2		Temp. Japonica	Russia	May 6	Jul. 29	Sep. 15	Aug. 3
137	K78		Temp. Japonica	India	May 4	Jul. 20	Sep. 17	Aug. 3
138	R.M.		Temp. Japonica	Italy	May 11	Aug. 3	Sep. 19	Aug. 4
139	Romeo		Temp. Japonica	Italy	May 6	Aug. 3	Sep. 15	Aug. 7

Note

	Ishigaki Ⅰ	Ishigaki Ⅱ	Ishigaki Ⅲ	Tsukuba
Sowing date	Feb. 21	May 23	Jul. 17	May 9
Transplanting date	Mar. 12	Jun. 17	Aug. 3	Jun. 12

研究資料

石垣島の二期作栽培におけるイネ品種の出穂の特徴

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摘　要

作物の育種において雑種集団初期世代の世代促進は育種操作の一つとして欠かせない手段となっており，最近育成された大部分の新品種は世代促進を経過している。沖縄県石垣島にある国際農林水産業研究センター沖縄支所では亜熱帯の立地条件を生かして圃場におけるイネおよびコムギの世代促進を1981年から行っている。遺伝変異の拡大を図り，多様な特性を有する品種を育成するため，イネの交配母本には日本品種のみならず，さまざまな外国品種が用いられている。外国品種を用いた雑種集団の固定には日本品種同士の雑種集団よりも長期間を要するが，このような雑種集団の世代促進を効率良く進めるため，さまざまなイネ品種の石垣島における出穂特性に関する知見を予め明らかにしておくことが重要である。

本報告では，石垣島における一期作および二期作における品種の出穂の特徴，あわせて日本本土のモデルとしてつくば市における出穂期と石垣島における出穂期を比較して，石垣島におけるイネ品種の出穂の特徴を報告する。

世界各地の在来イネ77品種および改良イネ62品種の合計139品種（インド型が55品種，日本型が84品種）を用いた。ただし，インド国の農業生態型品種群のアマンは含めなかった。

まず，石垣島における一期作と二期作における品種の出穂特性の違いを調査した。その結果，すべての品種において二期作の出穂迄日数は一期作より短くなり（Fig. 1），一期作，二期作ともに日本型品種群のほうがインド型品種群より出穂期の変異幅が大きかった（Table 1）。また，一期作，二期作ともに温帯の日本型品種群には早生が多く，熱帯の日本型品種群と温帯のインド型品種群には晩生が多いことが分かった（Table 1）。

つぎに，石垣島における品種の出穂特性を明らかにするため，茨城県つくば市をモデルとして出穂期を比較した。その結果，ほとんどのインド型品種群および熱帯の日本型品種群は低緯度の石垣島で栽培しても出穂はあまり早まらなかった。また，熱帯型を除く日本型品種群の多くは石垣市で栽培するとつくば市での栽培より出穂迄日数が短くなった。温帯の日本型品種はつくば市における出穂期と石垣島における出穂期の間で相関が小さく（Fig. 2），石垣島で早生個体を選抜するのは困難と推定した。

以上の結果から，石垣島の一期作，二期作におけるさまざまな品種の出穂特性および品種群の間の出穂特性の違いが明らかになり，効率的な世代促進栽培の基礎的な資料を得ることができた。

キーワード：イネ，インド型，出穂特性，世代促進，二期作，日本型，品種群

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