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PLANT GROWTH PHASES AND YIELD EVALUATION OF SOME EARLY RICE *(ORYZA SATIVA L.)* GENOTYPES UNDER DIFFERENT PLANTING SEASONS OF MANIPUR VALLEY

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ABSTRACT

Ten early rice genotypes were evaluated in order to ascertain the duration of plant gwoth phases, the various stages therin and their yelding ability under three rice planting scasons, viz. pre-*kharif, kharif* and late -*kharif,* of Manipur valley. Of the growth phases, maturity phase was found to be the most stable in terms of duration (days) irrespective of genotypes followed by reproductivephase. The duration of different plant growth stages among the genotypes was more or less similar during *kharif* and late-*kharif* seasons while the duration was significantly longer during the pre-*kharif* season.

The leaf age at different growth stages remained fairly constant in all the seasons. In terms of production, Norim 18 (732 g/sq.m). However, productivity was found to be the highest in the genotypes MAC-4 (5.61 g/sq.m/day) followed by Nirin 18 (5.57 g/sq.m/day) and RCM-7 (5.27 g/sq.m/day). Among the three planting seasons, the pre-*kharif* planting was recorded the highest grain yield and harvest index being attributed from the highest number of effective tillers and larger grain number.

INTRODUCTION

Rice being the staple food crop of Manipur, increase in rice production through rice based multiple cropping with appropriate modern rice varieties is a necessity wherever there is assured irrigation facilities. Although, the grain yeield in rice can be expressed as the product of total dry weight at harvest and harvest index the actual grain yeild is determined by a complex chain of developmental process which takes place in a definite sequence and any modification in anyone of them may influence the ultimate end product yeild. Therefore, the present investigation was undertaken in order to ascertain the developmental phases of plant growth and the yielding ability of some early rice genotypes under different rice planting seasons of Manipur valley.

MATERIALS AND METHODS

Ten rice genotypes, viz. RCM-5, RCM-6, RCM-7, RCM-8, MAC-1, MAC-2, MAC-3, MAC-4, Ch 988 and Norin 18 were used in the present study. The experiments were conducted in three rice planting seasons of Manipur valley, i.e. pre-*kharif* (March seeding), *kharif* (June seeding) and late-*kharif* (August seeding), during the year 1994 in a randomized block design with four replications. The experimental plot size was 3x3 sq.m with a spacing of 15 cm row to row and 10 cm plant to plant and 2 or 3 seedlings were planted per hill. A fertilizer dose @ 30:40:30 NPK kg/ha was applied as basal dose and 15N kg/ha was top dressed each at tillering and at panicle initiation stages.

Data on chronological age (days) and leaf age at different plant growth phases, viz. vegetative, reproductive and maturity including different stages therein were recorded from 5 randomly tagged plants. Data on grain yield per sq.m (g) and its ancillary characters, viz. seedling height (cm) at 4.5 leaf age, plant height at maturity (cm), ear bearing tillers per hill, spikelets per panicle, grains per panicle, 100 grain weight (g) and harvest index were also recorded following Gomez (1972). leaf age index number was calculated as the ratio of stagewise leaf age to the total leaf number of the genotype expressed in percentage. The experimental data were subjected to analysis of variance following Gomez and Gomez (1987).

RESULTS AND DISCUSSION

Chronological age (days) to different plant growth phases

Pooled mean of each genotype over seasons for chronological age (days) to different growth phases (Table 1) revealed that genotypes exhibited different growth duration in completing their growth phases according to their inherent characters. The total duration in completing the vegetative phase, in the present study, ranged from 54.46 days in MAC-1 to 75.23 days in RCM-5 and that of reproductive phase ranged from 23.82 days in MAC-1 to 33.04 days in Norin 18. The maturity phase, when compared with that of other two phases, exhibited a narrower range varying from 28.72 days in MAC-1 to 31.79 days in Norin 18. The present result, therefore, suggested that the maturity phase, among the three growth phases of rice plant, was the most stable in terms of their duration irrespective of the genotypes used and was followed by the reproductive phase. The present result confirmed the earlier reports of De Datta (1981), Mohanty (1990) and Tomar and Prasad (1991).

Tillering initiation started very early in the genotypes MAC-1, MAC-2, MAC-3, MAC-4, and Norin 18 (Table 1) thereby suggesting superiority of these lines to other genotypes studied in respect of early growth and development of tillers. It was further observed that maximum tillering stage was overlapped by or coincided with the panicle initiation stage in some of the early rice genotypes, viz. MAC-1, MAC-2 and MAC-4 suggesting absence of lag vegetative period in these genotypes. Similar result was also reported by Tomar and Prasad (1991) in gora varieties of Bihar.

Pooled season mean over the genotypes revealed that the durations to different growth stages during *kharif* and late-*kharif* plantings were more or less similar while the durations were significantly longer during pre-*kharif* planting. Lengthening of growth duration for different stages during pre-*kharif* planting might have been resulted from the low temperature during vegetative stage of plant growth and development in Manipur valley.

Leaf age to different growth phases

The total number of leaf, as recorded in thepresent study, varied from 13.81 in MAC-4 to 15.10 in Ch 988 (Table 2). The leaf age to tillering initiation stage for all the genotypes except RCM-5 and RCM-6 ranged from 4.09 to 4.89. The present result conformed with the findings of Yoshida (1981) and Tomar and Prasad (1991). RCM-5 and RCM-6 appeared to be inherently late tillering type. Differences in leaf age for tillering initiation in rice were also reported by Konokhova (1985) and Mohanty (1990). In all the three seasons, leaf age to different growth stages remained faily constant (Table 2). Constancy of leaf age in different planting seasons suggested photo-insensitivity of the rice genotype (Yoshida, 1981).

The leaf age index number measures the growth phases in rice irrespective of their leaf number. The leaf age index number to panicle initiationin the present study ranged from 82.84 to 86.88 for nine genotypes except RCM-7 for which leaf age index number to panicle initiation was recorded as 88.53 (Table 2).

Grain yeild and its ancillary characters

Among the genotypes, RCM-5, RCM-6 and Ch 988 were recorded with higher seedling and plant heights (Table 3). Among the seasons, higher seedling and plant heights were recorded during *kharif* and late-*kharif* plantings than that of the pre-*kharif* planting indicating favourable response of seedling and plant heights during warm temperature conditions of *kharif* and late-*kharif* seasons of Manipur valley.

The highest number of ear bearing tillers per hill was recorded from the genotypes MAC-4, Norin 18 and RCM-7. Ear bearing tillers per hill was found to be higher during pre-*kharif* season than that of *kharif* and late-*kharif* seasons. It indicated that pre-*kharif* planting was favourable for production of effective tillers in Manipur valley. Variations in theproductionof effective tillers among the genotypes and among the seasons were also reported by Ramalingam(1990) and Reddy and Choudhury (1991).

Among the genotypes, the highest number of spikelets per panicle was recorded from MAC-4 followed by RCM-6 while the highest number of grains per panicle was recorded from Norin 18 followed by MAC-4 (Table 3). The present finding suggested that the genotype which produced the highest number of spikelets per panicle did not necessarily produce the highest number of grains per panicle. The production of spikelets and grains per panicle in rice were the highest during *kharif* planting in Manipur valley while the lowest number of spikelets and grains per panicle in rice were recorded during pre-*kharif* and late-*kharif* plantings respecgively. The present result suggested that although the pre-*kharif* planting was favourable for grain filling, spikelet formation was not conductive. Similarly, the late-*kharif* planting was fabvourable for spikelet formation but unfavourable for grain filling. Similar observations as that of late-*kharif* planting were reported by Sahu (1980) and Oshida (1981). The grain weight recorded in all the three seasons were fairly constant suggesting that the grain weight in rice is a stable varietal characteristic. The present result confimed the earlier reports of Oshida (1981) and Rao (1990). Among the genotypes, Norin 18 recorded the highest 100 grain weight of 2.96 g.

The highest grain yield, among the genotypes, was recorded in Norin 18 followed by MAC-4, and RCM-7 (Table 3). In terms of productivity, the highest productive genotype was

found to be MAC-4 (5.61 g/sq/m./day) which was followed by Norin 18 (5.57 g/sq.m/day) and RCM-7 (5.27 g/sq.m/day). Among the planting seasons, higher grain yield was recorded from pre-*kharif* season. The possible reason for higher grain yield during pre-*kharif* season was due to higher effective tillers per hill and better grain filling capabilities during the season in Manipur valley. Higher harvest index was also recorded during pe-*kharif* planting than that of *kharif* and late-*kharif* plantings. Among the genotypes, MAC-4 recorded the highest harvest index of 49.30.

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Table 1. Pooled genotype and season means of chronological age (days) at different growth stages in earlygenotypes under different rice planting seasons of Manipur valley

Genotype and season	Plant growth phases									
	Vegetative phase			Reproductive phase			Maturity phase			
	Seeding (4.5 leaf age)	Tillering initiation	Maximum tillering	Panicle initiation	Booting	Heading	50% flowering	Milk	Dough	85% maturity
Gentype (G)										
MAC-1	22.92	21.53	53.38	45.46	69.04	74.89	78.28	85.67	91.51	107.00
MAC-2	21.98	20.46	54.13	56.32	70.54	70.06	79.97	85.80	91.00	109.33
MAC-3	21.85	20.43	52.98	56.05	70.09	74.77	78.13	84.79	89.85	108.00
MAC-4	21.54	21.43	55.77	56.80	71.05	75.96	81.57	87.01	91.91	112.68
RCM-7	23.50	24.75	54.99	58.22	72.89	80.76	84.83	89.24	95.32	115.00
RCM-8	24.69	27.13	56.40	62.07	7.44	82.24	88.34	91.92	98.07	119.33
RCM-5	23.40	36.05	62.28	75.23	90.50	97.89	102.96	109.39	114.13	133.00
RCM-6	23.71	37.34	62.73	74.32	93.56	98.41	103.26	108.56	113.33	133.33
Ch988	21.71	23.42	60.29	66.90	84.44	91.76	99.91	104.16	111.89	130.33
Norin 18	22.07	22.00	59.66	66.50	84.78	91.23	99.54	102.85	109.76	131.33
Season (s)										
Pre-*kharif*	26.80	28.52	65.76	79.70	94.49	101.11	104.68	110.54	115.47	134.80
Kharif	21.08	23.16	51.32	53.62	69.64	75.55	81.27	85.52	91.49	111.10
Late-*kharif*	20.94	24.68	54.70	54.74	71.17	76.53	83.20	88.76	95.23	113.50
C.D. (G) p=0.05	3.00	3.21	5.46	4.87	2.73	3.82	5.76	4.96	4.65	5.67
C.D. (S) p=0.05	1.64	1.76	2.98	2.67	1.49	2.08	2.15	2.71	2.50	3.11

Table 2. Pooled genotype and season means of of leaf age (number) at different growth stages in early rice genotypes under different planting seasons of Manipur valley

Genotype and season	Leaf age				
	Seedling	Tillering initiation	Maximum tillering	Panicle initiation	Total leaf
Genotype (G)					
MAC-1	4.50	4.16	11.17	11.54	13.93
	(32.30)	(29.86)	(80.19)	(82.84)	(100.00)
MAC-2	4.50	4.10	11.57	11.99	14.44
	(31.16)	(28.39)	(80.12)	(80.03)	(100.00)
MAC-3	4.50	4.09	11.41	11.59	13.97
	(32.21)	(29.28)	(81.68)	(82.96)	(100.00)
MAC-4	4.50	4.40	11.57	11.83	13.81
	(32.59)	(31.86)	(83.78)	(85.66)	(100.00)
RCM-7	4.50	4.66	11.91	12.35	13.95
	(32.26)	(33.41)	(85.38)	(88.53)	(100.00)
RCM-8	4.50	4.57	12.52	12.73	14.70
	(30.61)	(31.09)	(85.17	(86.60)	(100.00)
RCM-5	4.50	6.87	12.31	12.67	14.71
	(30.59)	(46.70)	(83.68)	(86.13)	(100.00)
RCM-6	4.50	6.73	12.10	12.78	14.71
	(30.59)	(45.75)	(82.27)	(86.88)	(100.00)
Ch988	4.50	4.89	12.35	12.76	15.10
	(29.80)	(32.38)	(81.79)	(84.50)	(100.00)
Norin 18	4.50	4.50	11.95	12.38	14.86
Season (s)					
Pre-*kharif*	4.50	4.82	11.98	12.51	14.55
	(30.93)	(33.12)	(82.34)	(85.98)	(100.00)
Kharif	4.50	4.89	11.71	1.81	14.39
	(31.27)	(33.98)	(81.38)	(84.64)	(100.00)
Late-*kharif*	4.50	5.00	11.95	12.10	14.32
	(31.42)	(34.92)	(83.45)	(84.50)	(100.00)
C.D. (G) p=0.05	-	0.50	0.29	0.29	0.43
C.D. (S) p=0.05	-	0.27	0.17	0.17	0.25

Data within the parentheses are the leaf age index number.

Table 3. Pocled data of yield and its ancillary characters fotr early rice genotypes under different ricve planting season of Manipur valley.

Genotype & season	Seedling height (cm)	Plant height (cm	Ear bearing tillers/plant	Spikelets/ panicle	Grains/ panicle	100 grain weight (g)	Grain yield (g/sq.m)	Harvest index
Gentype (G)								
MAC-1	21.43	82.30	6.27	75.25	37.14	2.49	358	30.80
MAC-2	23.06	92.42	6.56	92.59	50.58	2.81	596	44.02
MAC-3	23.54	91.43	5.30	87.39	47.22	2.85	472	43.11
MAC-4	21.22	84.24	8.03	97.85	59.11	2.18	632	49.30
RCM-7	22.68	91.65	7.31	86.76	54.88	2.23	606	40.84
RCM-8	22.46	92.73	6.54	70.53	41.02	2.82	456	38.08
RCM-5	25.72	133.18	5.50	80.92	38.66	2.62	356	24.12
RCM-6	27.55	135.40	4.92	97.43	50.36	2.63	403	24.73
Ch988	27.98	123.25	6.71	77.10	51.90	2.79	576	32.83
Norin 18	22.85	104.74	7.86	75.76	61.07	2.96	732	37.88
Season (s)								
Pre-*kharif*	15.01	93.76	7.50	71.75	51.09	2.62	622	45.29
Kharif	28.55	108.99	5.99	96.22	56.24	2.64	503	36.41
Late-*kharif*	27.99	106.65	6.06	84.56	40.26	2.63	412	27.87
C.D. (G) p=0.05	3.13	5.65	0.84	13.97	9.56	0.01	84	3.84
C.D. (S) p=0.05	1.70	3.11	0.46	7.65	5.23	0.02	46	2.11