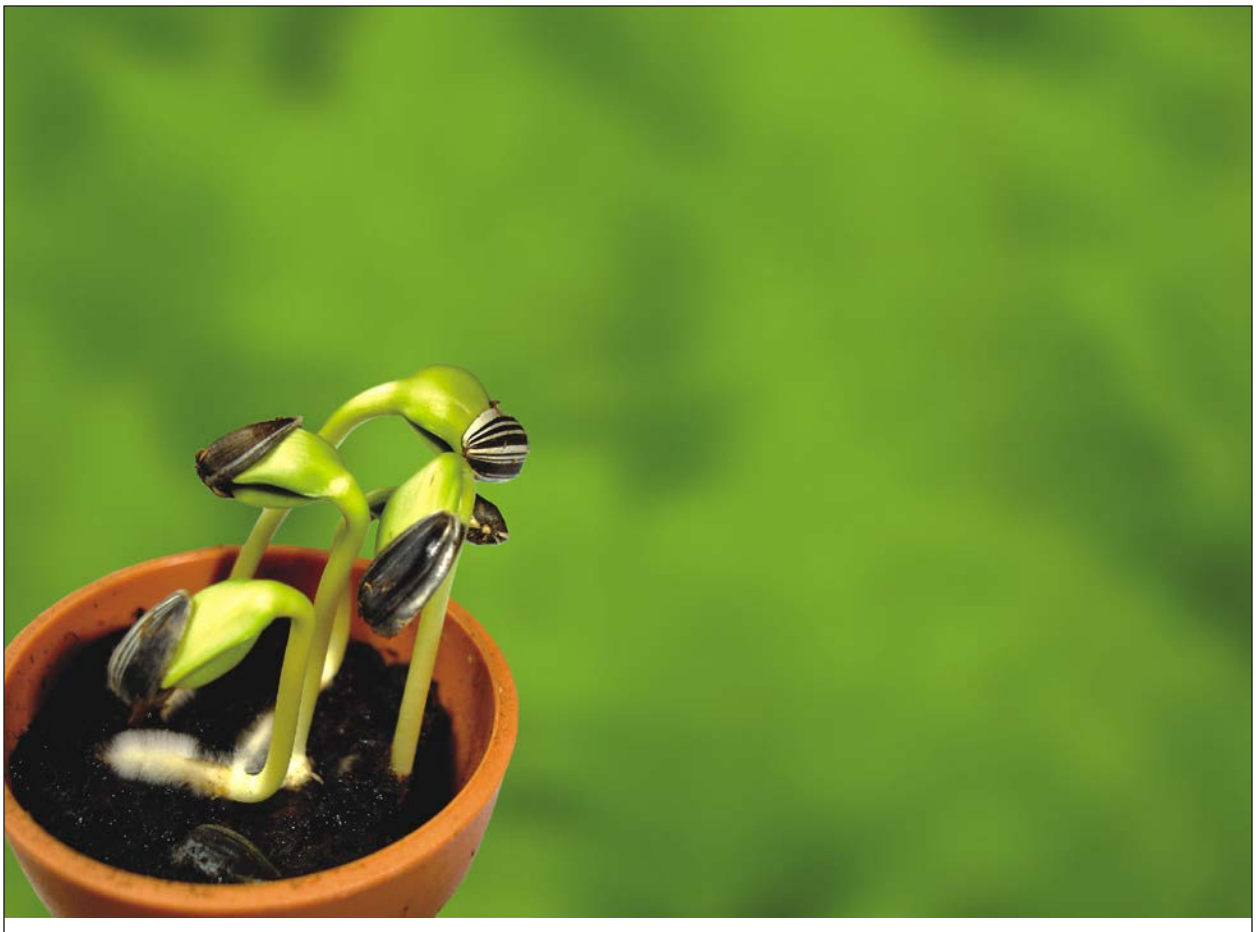

International Journal of Plant Breeding and Genetics

ISSN 1819-3595

Academic Journals Inc.

www.academicjournals.com

International Journal of Plant Breeding and Genetics 2 (1): 9-12, 2008
ISSN 1819-3595

Relative Contribution of Rice Tillers of Different Status Towards Yield

K.V. Mohanan and C.B. Mini
Genetics and Plant Breeding Division, Department of Botany,
University of Calicut, Kerala-673635, India

Abstract: A new rice plant type with optimum number of tillers, all productive and uniformly maturing has been suggested presently based on the study of relative contribution of tillers of different status towards grain yield. Rice germinates as a single culm and soon it starts tillering. Primary tillers are produced first, followed by secondary and tertiary tillers. Tertiary tillers are produced in high tillering varieties only. The present study has shown that they are late emerging and they flower and mature late, thus not contributing to economic crop yield. Tertiary tillers flowered only 14-29 days after the first flowering of the plants and the panicles were unripe at the time of harvest. Hence the approach should be to develop a medium tillering plant type with primary and secondary tillers emerging and flowering synchronously. Increasing the number of grains per panicle should also be a major criterion in developing a new rice plant type.

Key words: Rice, plant type, tillering, tillers, tertiary tillers, flowering of tillers

INTRODUCTION

Most of the pre green revolution rice varieties were tall and leafy with weak stems and lodging habit. Their harvest index was only around 0.3 indicating their low yield potential. During the course of development of rice varieties suitable for green revolution, the harvest index and biomass production were increased mainly by the reduction of plant height through the incorporation of the recessive gene sd-1 for short stature from a Chinese variety Deo-Geo-Woo-Gen and also by the development of high tillering varieties. However, further studies indicated certain drawbacks in the case of the high tillering varieties like non synchronized flowering of tillers resulting in non uniform maturity. Rice germinates as a single culmed seedling but soon it starts tillering. Tillering potential of rice is a varietal character and the tillering phase of a variety depends upon its duration and morphology. The first produced tillers in rice are primary in nature followed by secondary and tertiary tillers. However, late emerging tillers may not contribute towards the yield of mature grains at harvest. Khush (1994) has conceptualized a new plant type in rice with lower tillering capacity, absence of unproductive tillers, higher number of grains per panicle, medium height, sturdy stems, dark green, thick and erect leaves, thickened, deepened roots, multiple disease and insect resistance and acceptable grain quality. Under these circumstances a study was carried out presently to analyse the tillering potential and the behaviour of tillers in terms of their emergence and performance in the case of 10 native rice cultivars of Kerala state of India (Table 1).

MATERIALS AND METHODS

The present experiment was carried out in the experimental net house of the Genetics and Plant Breeding Division of the Department of Botany of University of Calicut, Kerala, India in the first crop season of 2003 using 10 native rice cultivars of Kerala with 12 plants per variety (Table 1). The plants

Corresponding Author: K.V. Mohanan, Genetics and Plant Breeding Division, Department of Botany, University of Calicut, Kerala-673635, India

Table 1: Tiller related analysis of plant and yield characters in rice

Variety	Mother tillers	Primary tillers	Secondary tillers	Tertiary tillers	Day of first tiller production
Days taken for tiller emergence					
Chuvanna chitteni	On the day of	53.57±14.48	67.47±6.54**	87.50±13.23**	34
Chuvanna vattan	germination	40.79±13.94	55.17±6.02**	58.88±5.07**	21
Thekkan cheera		43.96±11.13	55.30±8.62**	57.80±2.77**	27
Thekkan chitteni		54.07±13.98	64.32±9.97**	70.50±2.65**	38
Thondi		34.75±11.24	58.08±2.01**	-	26
Chemmeen		46.79±8.49	49.77±5.81	-	33
Kuruva		44.43±9.36	52.04±4.78**	52.25±1.71**	32
Chitteni		47.44±15.73	59.50±10.66**	72.00±5.00**	28
Vellarian		49.64±17.37	60.73±7.24**	68.00±0.82**	29
Kunhu kunhu		39.25±7.56	51.95±11.37**	-	30
Days taken for flowering					
					Day of first flowering
Chuvanna chitteni	84.00	86.71±4.39	97.25±7.51**	109.67±3.21**	81
Chuvanna vattan	100.00	98.21±3.56	95.36±3.81**	108.50±0.71**	95
Thekkan cheera	82.00	86.09±3.27**	93.74±9.62**	103.30±18.90**	82
Thekkan chitteni	90.00	99.60±5.47**	108.40±9.42**	-	90
Thondi	96.00	100.08±2.97**	106.08±2.91**	-	96
Chemmeen	95.00	98.57±4.24*	102.90±3.79**	-	95
Kuruva	84.00	84.50±0.71	88.75±6.88*	-	84
Chitteni	76.00	84.00±5.56**	90.54±6.34**	98.67±3.21**	76
Vellarian	101.00	102.41±3.24	104.38±1.43**	-	101
Kunhu kunhu	75.00	75.65±3.06	74.67±4.22	-	73
No. of leaves					
					Plant total
Chuvanna chitteni	4.00	4.00±0.00	4.24±0.44*	3.00±0	106
Chuvanna vattan	6.00	5.75±0.46	5.67±0.49**	4.33±0.58**	150
Thekkan cheera	5.00	5.11±0.33	4.83±0.38*	4.00±0	145
Thekkan chitteni	6.00	5.50±0.55*	5.50±0.53**	-	78
Thondi	7.00	6.67±0.52	5.60±0.55	-	75
Chemmeen	7.00	6.71±0.49	6.30±0.67**	-	117
Kuruva	6.00	5.67±0.52	5.00±0.87	-	85
Chitteni	5.00	4.88±0.64	4.33±0.65**	3.50±0.71**	103
Vellarian	6.00	6.00±0.00	5.56±0.53	-	92
Kunhu kunhu	7.00	6.00±0.00	6.40±0.42**	-	69
Tiller height (cm)					
					Plant height
Chuvanna chitteni	72.40	71.27±5.42	61.66±4.74**	49.50±4.53**	77.30
Chuvanna vattan	93.00	88.33±5.41*	80.33±5.42**	74.42±9.14**	98.25
Thekkan cheera	92.80	85.36±3.88**	73.96±3.26**	65.70±8.21**	92.80
Thekkan chitteni	98.20	88.81±7.50*	77.81±2.90**	-	98.20
Thondi	110.30	104.44±7.35	106.08±2.91	-	112.90
Chemmeen	109.00	93.17±10.69**	84.84±5.39**	-	109.00
Kuruva	93.00	84.88±9.70*	71.01±4.96**	-	97.50
Chitteni	91.40	77.73±8.14**	64.67±11.26**	58.25±0.35**	91.40
Vellarian	113.30	102.26±10.05**	99.07±2.67**	-	113.30
Kunhu kunhu	65.20	57.52±5.76**	48.20±2.67	-	65.20
Panicle length (cm)					
					Plant mean
Chuvanna chitteni	16.80	14.42±0.82**	12.73±0.98**	10.35±0.49**	13.14
Chuvanna vattan	19.00	18.28±1.13	16.56±1.80**	15.60±1.81**	17.34
Thekkan cheera	17.70	17.90±1.28	16.46±2.51*	16.50±0*	16.99
Thekkan chitteni	21.20	19.43±0.78**	16.10±3.32**	-	17.57
Thondi	24.50	22.52±1.57*	17.99±2.50**	-	20.80
Chemmeen	21.60	18.39±1.97**	17.24±1.36**	-	18.09
Kuruva	20.40	18.25±1.36**	14.28±1.31**	-	16.42
Chitteni	15.75	15.77±1.64	15.36±2.39	15.25±1.77	15.49
Vellarian	22.30	21.43±0.36**	17.62±3.28**	-	19.24
Kunhu kunhu	19.06	16.80±1.85**	14.28±2.99**	-	15.86

Table 1: Continued

Variety	Mother tillers	Primary tillers	Secondary tillers	Tertiary tillers	Plant mean
Spikelets per panicle					
Chuvanna chitteni	43.00	32.41±1.90**	28.17±4.26**	17.00±7.07**	20.99
Chuvanna vattan	39.00	33.94±10.55	32.70±6.88**	25.83±7.01**	33.00
Thekkan cheera	52.00	37.88±14.46*	33.91±8.94**	31.00±0**	35.88
Thekkan chitteni	74.00	56.99±6.54**	38.92±7.60**	-	46.88
Thondi	127.00	99.90±27.81*	43.50±11.82**	-	78.67
Chemmeen	75.00	59.36±18.96*	48.90±7.71**	-	54.42
Kuruva	93.00	66.92±10.73**	40.25±9.02**	-	55.61
Chitteni	49.00	41.21±8.67	34.00±4.05**	22.00±0**	36.52
Vellarian	89.00	63.08±9.86**	41.33±6.32**	-	52.44
Kunhu kunhu	96.00	72.75±15.06	59.70±20.24**	-	68.89
Seeds per panicle					
Chuvanna chitteni	39.00	29.47±2.87**	25.08±3.64**	14.00±7.07**	25.91
Chuvanna vattan	35.00	36.13±8.08	30.20±6.79**	22.50±6.06**	32.42
Thekkan cheera	48.00	38.76±5.48**	28.79±7.75**	25.00±0**	32.76
Thekkan chitteni	70.00	54.25±6.18**	36.55±7.66**	-	44.32
Thondi	122.00	94.90±26.64*	39.70±13.25**	-	74.17
Chemmeen	74.00	56.07±17.62*	46.75±8.91**	-	51.86
Kuruva	89.00	63.17±9.89**	38.50±8.56**	-	52.64
Chitteni	46.00	36.07±9.10*	27.88±4.52**	17.00±0**	30.93
Vellarian	85.00	59.58±10.53**	37.50±6.94**	-	48.72
Kunhu kunhu	88.00	65.20±15.87**	51.90±19.70**	-	61.24
Panicle density					
Chuvanna chitteni	2.58	2.22±0.16**	2.20±0.23**	1.66±0.76**	2.18
Chuvanna vattan	2.08	2.03±0.28	1.89±0.28*	1.65±0.26*	1.99
Thekkan cheera	2.83	2.31±0.27**	2.06±0.34**	1.88±0**	2.16
Thekkan chitteni	4.19	4.23±1.27	2.32±0.36**	-	3.06
Thondi	5.15	4.37±0.99	2.73±0.76**	-	3.75
Chemmeen	3.47	3.13±0.75	2.62±0.49**	-	2.86
Kuruva	4.55	3.53±0.36**	2.79±0.42**	-	3.23
Chitteni	3.10	2.57±0.36**	2.18±0.30**	1.60±0**	2.32
Vellarian	3.90	2.93±0.38**	2.46±0.69**	-	2.73
Kunhu kunhu	4.90	4.28±0.51**	3.76±0.99**	-	4.10
Fertility (%)					
Chuvanna chitteni	90.00	88.83±4.08	85.91±7.35**	80.68±8.03**	86.44
Chuvanna vattan	91.00	93.98±3.69*	93.03±5.22**	87.07±4.42**	92.51
Thekkan cheera	92.00	91.09±4.46	84.71±3.35**	80.64±0**	86.96
Thekkan chitteni	96.00	95.69±1.99	94.11±3.02**	-	94.72
Thondi	96.00	94.95±2.56	90.78±6.53	-	93.32
Chemmeen	98.00	93.69±2.32**	94.77±4.35*	-	94.53
Kuruva	95.00	94.26±1.32	95.05±2.85	-	94.72
Chitteni	94.00	86.95±5.89*	80.77±6.59**	77.27±0**	83.28
Vellarian	95.00	92.33±3.42*	90.16±4.31**	-	91.29
Kunhu kunhu	90.00	91.26±1.65	85.43±5.85	-	91.20

**: Significant at 1% level; *: Significant at 5% level (t-test)

were grown in 20 cm pots filled with paddy soil + sand + enriched compost in 4:1:1 proportion under wetland condition with one plant per pot and applying 1 g Factamfos (N:P:K:S :: 15:15:0:15) per plant at monthly intervals starting from 30th day onwards till flowering. Performance of tillers of different ranks has been analysed based on mean, standard deviation and comparison of means by t test in relation to the characters studied.

RESULTS AND DISCUSSION

Rice germinates as a single culm known as mother tiller. Subsequently it gives rise to primary, secondary and tertiary tillers. As a general rule, primary tillers develop first, followed by secondary and tertiary tillers. In the case of ten rice varieties studied for the purpose, seven produced primary,

secondary and tertiary tillers where as three, produced only primary and secondary tillers. In all the cases tertiary tillers emerged significantly late indicating the possibility of their inability to contribute mature grains at the time of harvest (Table 1). Tertiary tillers flowered in the case of three varieties only and they flowered 14-29 days after the first flowering of the plants, thus further indicating their unripe condition at the time of harvest. Tertiary tiller height was significantly low in the case of all the four varieties which developed healthy tertiary tillers. Seeds per panicle and panicle density were found to be low in the case of tertiary tillers. Panicle length, spikelets per panicle and seeds per panicle were also significantly low in tertiary tillers in most of the cases. The above study indicates the relative non contributing nature of tertiary tillers thus emphasizing the need for developing rice varieties with optimum numbers of primary and secondary tillers and with out tertiary tillers so that uniform ripening, harvest and maximum yield is possible. Increasing the number of primary tillers and reducing the number of secondaries should also be considered a breeding priority in rice for better synchronized flowering and maturity of tillers.

Khush (1994, 2000) has indicated the importance of high density planting of optimum or even low tillering rice varieties so as to improve the yield potential of rice. Reduced tillering facilitates synchronized flowering and maturity, uniform panicle size and heavier grains. According to Rao (1987), number of grains produced per unit area determines grain yield. However, the modern high yielding varieties that have replaced the traditional varieties have got higher tiller and panicle numbers, the additional tillers becoming unproductive as opined by Khush (2000). Hence the approach should be to increase the number of grains per panicle rather than number of panicles per plant. In other cereals like maize and jowar also yield potential has been increased by increasing the ear size (Khush, 1993).

REFERENCES

Khush, G.S., 1993. Varietal Needs for Different Environments and Breeding Strategies. In: New Frontiers in Rice Research, Muralidharan, K. and E.A. Siddiq (Eds.). Directorate of Rice Research, Hyderabad, India, pp: 68-75.

Khush, G.S., 1994. Increasing the genetic yield potential of rice: Prospects and approaches. Int. Rice Commun. Newslett., 43: 1-8.

Khush, G.S., 2000. New Plant Type of Rice for Increasing the Genetic Yield. In: Rice Breeding and Genetics Research Priorities and Challenges, Nanda, J.S. (Ed.). IRRI, Manila, Philippines, pp: 99-108.

Rao, P.S., 1987. High density grain among primary and secondary tillers of short and long duration rices. IRRN, 12 (4): 12.