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Influence of main crop characters on yield of ratoon rice

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ABSTRACT

Fifty rice genotypes of different eco-geographical origin were evaluated during the wet season 1999-2000 for assessing the characters of main crop which can contribute to a better ratoon yield. Results revealed that ratoon yield could be improved by long duration rice varieties producing more number of grains panicle^{-1}, more number of unproductive tillers plant^{-1} and reduced grain production day^{-1}. Among the genotypes, five high yielding varities viz. CO 43, IR 20, White Ponni, Ponmani and Mangala Mahsuri recorded better ratoon performance.

Key words: *Ratoon yield, elite lines, local varieties*

Ratoon cropping of rice has been suggested as one of the ways of increasing rice production without increasing the land area (Mahadevappa, 1979). Therefore, superior ratooning genotypes with desirable attributes *viz*. more number of productive tillers plant^{-1} and grains panicle^{-1} with higher 1000 grain weight were to be identified. Even though few cultivars were identified by Karunakaran *et al.* (1983), detailed evaluation was yet to be conducted to identify superior ratooning genotypes. Hence, the investigation was carried out to find out the main crop characters, which contribute to a better ratoon performance.

MATERIALS AND METHODS

The study was conducted at Agricultural Research Station, Mannuthy of Kerala Agricultural University during wet season 1999-2000. Fifty rice genotypes comprising of local strains, high yielding varieties and elite breeding lines were tested in a randomised complete block design (RBD) with three replications adopting a spacing of 20 x 15 cm and a plot size of 3.75 m^2. Karunakaran *et al*. (1983) reported poor stubble regeneration while the main crop was harvested at 15 cm. So in the present study, the main crop was harvested leaving stubbles to a height of 30 cm. Stubbles were then allowed to regenerate. Fertilizer does of one fourth of the main crop recommendation ($N:P_2:K_2O$ at 90:45:45 kg ha^{-1}) was applied to the ratoon crop two days after the harvest of the main crop. Performance of the main and ratoon crops were studied. Data obtained were subjected to correlation and path coefficient analysis to find out the main crop characters for a better ratoon crop and total yield.

RESULTS AND DISCUSSION

Performance of high yielding varities, elite breeding lines, and local varieties in the main crop as well as ratoon crop are presented in Table 1. The high yielding varieties performed better as ratoon crops in comparison to the elite strains and local varieties. Morphological characters of the ratoon crop were less pronounced compared to the main crop with less number of productive tillers plant^{-1}, grains panicle^{-1}, 1000 grain weight, ratoon grain yield, grain length and grain thickness. Regenerated tillers from the left over stubbles flowered directly without passing through a vegetative phase and almost all tillers regenerated were panicle bearing in nature.

The genotypic and phenotypic correlation coefficients among different main crop characters and ratoon yield were investigated (Table 2). The main crop characters *viz*. days to flowering and days to harvest showed positive and significant correlation with ratoon yield both at genotypic and phenotypic levels. Grains panicle^{-1} and number of unproductive tillers plant^{-1} of the main crop were positively and significantly correlated

Table 1. Mean performance of main vis-a-vis ratoon crop characters

Genotypes	Grains panicle^{-1}	Number of unproductive tillers plant^{-1}	Number of productive tillersplant^{-1}	1000 grain weight(g)	Grain yield (kg.ha^{-1})	Days to flowering	Grain productionday (g day^{-1})	Grain length (mm)	Grain thickness (mm)
HYVs									
Main (40)	152.95	5	7.20	25.38	6959.83	106.50	18.58	8.46	2.10
Ratoon (21)	37.48	0.24	3.14	21.66	1234.61	42.33	7.45	7.77	1.42
Elite strains									
Main (4)	158.25	3	8.00	27.49	7543.25	110.00	20.00	7.69	2.17
Ratoon (2)	38.00	0.32	2.00	23.22	670.20	41.00	4.05	7.11	1.43
Local varieties									
Main (6)	155.67	3	7.83	27.60	6955.83	100.67	20.00	8.32	2.13
Ratoon (1)	31.00	0.65	2.00	19.77	768.90	66.00	3.28	7.17	1.45

Figures in parenthesis indicate the number of genotypes studied

Table 2. Genotypic and phenotypic correlations among selected main crop characters and ratoon yield.

Main crop Character	Days to flowering	Days to harvest	Number of unproductive tillers plant^{-1}	1000 grain weight (g)	Grains panicle^{-1}	Grain length (mm)	Grain thickness (mm)	Grain production day^{-1} (g day^{-1})	Ratoon yield (kg.ha^{-1})
Days to flowering	1 (1)								
Days to harvest	0.826** (0.823**)	1 (1)							
Number of unproductive tillers plant^{-1}	0.682** (0.413*)	0.600** (0.375*)	1 (1)						
1000 grain weight (g)	-0.241 (-0.223)	-0.249 (-0.231)	-0.446** (-0.268)	1 (1)					
Grains panicle^{-1}	0.020 (0.014)	-0.115 (-0.090)	-0.066 (-0.0005)	-0.316* (-0.209)	1 (1)				
Grain length (mm)	-0.302* (-0.253)	-0.184 (-0.159)	-0.203 (-0.035)	0.478** (0.394*)	-0.499** (-0.370*)	1 (1)			
Grain Thickness (mm)	0.107 (0.077)	0.157 (0.110)	-0.073 (-0.047)	0.570** (0.356*)	-0.287 (-0.265)	-0.221 -(0.033)	1 (1)		
Grain production day^{-1} (g day^{-1})	-0.611** (-0.501**)	-0.689** (-0.574**)	-0.492** (-0.303*)	0.351* (0.253)	0.064 (0.056)	0.017 (-0.034)	-0.021 (0.002)	1 (1)	
Ratoon yield (kg.ha^{-1})	0.448** (0.352*)	0.536** (0.426*)	0.496** (0.234)	-0.612** (-0.474**)	0.394* (0.236)	-0.313* (-0.223)	-0.363* (-0.204)	-0.497** -(0.288)	1 (1)

CD (P=0.05) (0.301); 1% (0.445)

*and ** significance at =0.05 and 0.01 respectively

Figures in parentheses indicate phenotypic correlation

with ratoon yield at genotypic level. Hence, high ratoon yield could be achieved by a simultaneous selection for a long duration crop variety having more number of grains panicle^{-1} and unproductive tillers plant^{-1}. Tillers, which remained dormant in the first crop, may also give rise to fresh productive tillers during ratoon period, thereby contributing to an increased ratoon yield as reported earlier (Sompaew, 1979). Negative and significant correlations at genotypic level was observed for 1000 grain weight, grain production day^{-1}, grain length and grain thickness.

Path analysis was carried out using significant

genotypic correlations of nine main crop characters in order to find out the interaction of various main crop characters with ratoon yield (Table 3). The highest positive direct effect was exhibited by grains panicle^{-1} (0.921) on ratoon yield. This was followed by grain length (0.849), grain thickness (0.586) and grain yield of main crop (0.584). Highest negative direct effect on yield was obtained for 1000 grain weight (-0.841) followed by grain production day^{-1} (-0.665).

Results of path analysis indicated that genotypes having superior grain and ear head characters in the main crop produced high ratoon yield. Number of unproductive tillers in the main crop had high positive direct effect on ratoon yield. This character even though did not positively correlate; the main crop yielded a better ratoon crop by higher number of productive tillers in the ratoon crop. The high tillering genotypes were having more number of dormant tillers in the present investigation. The local types were low tillering genotypes and the stubbles decayed soon after the harvest. Only high yielding varieties and elite strains with more number of productive tillers along with a higher proportion of dormant ones later produced a good ratoon crop. Highest negative direct effect was manifested by 1000 grain weight followed by grain production day^{-1}. Both the characters were negatively correlated with ratoon grain yield. When grain production day^{-1} is lower in main crop, than there will be more chance for diversion of food to the carry over crop, and can explain the negative direct effect and significant negative correlation. This can also be confirmed by the high correlation between days to maturity of the main crop and ratoon yield as reported earlier by Prakash and Prakash (1987), Arumugachamy *et al.* (1993) and Liang, (1997).

Therefore, a better performing ratoon genotype can be selected based on the main crop characters such as long duration, more number of grain panicle^{-1}, more number of unproductive tillers plant^{-1} and reduced grain production day^{-1}. Among the various genotypes tested high yielding varieties were performing well in the ratoon crop followed by elite breeding lines. The local strains were showing poor performance in the ratoon crop.

Table 3. Direct and indirect effects of main crop characters on ratoon yield

Main crop Characters	Grains panicle^{-1}	Number of unproductive tillersplant^{-1}	Number of productive tillersplant^{-1}	1000 grain weight(g)	Main crop grain yield (kg.ha^{-1})	Days to flowering	Grain production day^{-1} (g day^{-1})	Grain length (mm)	Grain thickness (mm)	Correlation coefficient with ratoon yield
Grainspanicle^{-1}	**0.921**	-0.015	-0.112	0.266	-0.029	0.000	-0.043	-0.425	-0.168	0.394
Number of unproductive tillersplant^{-1}	-0.062	**0.227**	-0.086	0.377	-0.075	0.007	0.329	-0.174	-0.043	0.496
Number of productive tillersplant^{-1}	-0.325	-0.061	**0.318**	0.111	0.073	-0.004	-0.195	-0.064	-0.147	-0.292
1000 grain weight(g)	-0.292	-0.102	-0.042	**-0.841**	0.157	-0.002	0.234	0.406	0.335	-0.612
Main crop grain yield(kg.ha^{-1})	-0.045	-0.029	0.039	-0.227	**0.584**	0.000	-0.484	-0.121	0.066	-0.215
Days to flowering	0.019	0.156	-0.122	0.203	-0.028	**0.010**	0.407	-0.257	0.063	0.448
Grain productionday^{-1}(g day^{-1})	0.059	-0.112	0.093	-0.295	0.425	-0.006	**-0.665**	0.015	0.013	-0.497
Grain length(mm)	-0.462	-0.046	-0.024	-0.402	-0.083	-0.003	-0.012	**0.849**	-0.131	-0.313
Grainthickness(mm)	-0.265	-0.017	-0.080	-0.481	0.066	0.001	0.014	-0.190	**0.586**	-0.363

Bold figures indicate direct effects

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