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Studies on Natural Cross Pollination in Rice at Coimbatore*

by

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Synopsis: The results of experiments conducted at the Paddy Breeding Station, Coimbatore for four years from 1955—'56 to study the extent of natural cross pollination under Coimbatore conditions in two long duration paddy strains CO. 19 and CO. 12 are reported in this paper.

Introduction: A knowledge on the extent of natural crossing in rice varieties and the spatial isolation that will prevent natural crossing would aid the maintenance of purity in varieties. Rice is autogamous but natural cross pollination has been found to occur to varying degrees. Jones (1929) observed that natural cross pollination in rice varied from country to country and from variety to variety. Kadam and Patil (1933) found that natural crossing in rice at Karjat (Bombay) occurred to an extent of 0·5%. They observed that contamination by natural crossing did not diminish gradually as the distance from the male parent increased. The per cent of natural cross pollination in female parents was found to be 0·005, 0·036, 0·037 and 0·030 at 3', 6', 14' and 22' away from the male parent respectively. Fotidar (1945) found that natural cross pollination under Kashmir conditions was 0·01% and attributed this negligible per cent of cross pollination to low temperature and absence of wind. However, the natural crossing occurred in the direction of wind at the time of flowering and upto a distance of 15 feet. Larter (1950) reported that the extent of natural cross pollination of wet paddy in Malaya was of the order of 1%. Butany (1957) at Cuttack found that natural cross pollination varied from nil to 6·80% with an overall average of 0·934% and the contamination occurred at a distance of 10' to 15'.

Ramiah (1953) while reviewing the work on natural crossing has observed that among the cultivated rice varieties, it varied from 0·1% at Sabour (Bihar) to 4·0% in Bengal. In Aduthurai (Madras) Srinivasan and Subramanian (1961) found that the percentage of natural crossing ranged from 0·34 to 0·03 per cent and the distance upto which natural cross pollination took place ranged from 6 to 7 feet from the pollinating parent. Gurcharn Singh and Sohan Singh Saini (1961) in Punjab recorded that natural cross pollination under Kangra Valley conditions ranged from 0 to 2·94 per cent with an average of 0·035 per cent.

Materials and Methods: The experiment to study the extent of natural crossing under Coimbatore conditions was started at the Paddy Breeding Station, Coimbatore during 1955—'56 and continued for four years. Two long duration strains CO. 19 and CO. 12 were grown with CO. 19 as the pollinating parent as it possessed the marker gene for glume colour at ripening viz., brown in furrows in contrast to the ripening gold glume colour of the seed parent CO. 12. CO. 19 had a flowering duration of 140 days while CO. 12 was of 135 days flowering duration. Sowing of these varieties was adjusted so that their flowering synchronised.

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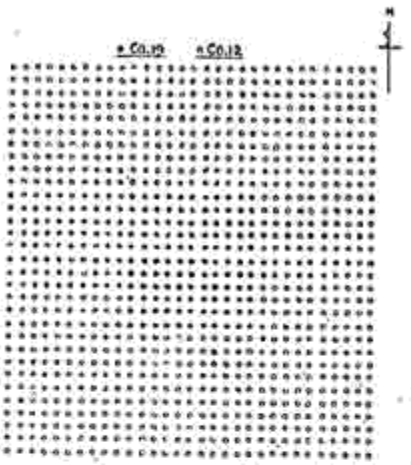
The layout adopted was similar to what has already been reported by Fetidar (1945). It consisted of planting of pollinating parent CO. 19 in a plot of 10 feet square in the centre of the field surrounded by the seed parent CO. 12 adopting a spacing of 1' x 1' using single seedlings. On all sides of the pollinating parent the seed parent CO. 12 was planted in stripe of 10' x 10' with a spacing of one foot between seedlings. Thus the CO. 12 plants were available at different known distances from the pollinating parent from 1 foot upto 10 feet (Plate). On maturity, six single plants were selected at random from each row on all the four sides thus making a total of 240 single plants. An additional 16 plants from the four corner plots, four from each corner were also selected at random. Selection of plants was restricted due to the availability of limited area for growing the progenies.



Natural Cross Pollination Studies—Field Lay-out of Pollination parent CO. 19. and seed parent CO. 12.

During 1956—'57 the progenies from these 250 single plants were grown in singles spaced, 6" apart and examined at flowering as well as at maturity. Hybrids showing the dominant ripening brown in furrows character that had resulted due to natural cross pollination were tagged. A total population of 34,693 plants was individually studied for this purpose and natural crossing was estimated. The experiment was repeated during the three subsequent years from 1957—'58 to 1959—'60 and the population studied during these years were 9,052, 96,016 and 32,781 single plants respectively.

Results and Discussion: The data relating to the number of natural hybrids observed in each row in the different directions and the per cent natural crossing computed from the four years of trial are presented in the tables I a, b, c and d.

The data showed that the mean per cent of natural crossing varied from 0·004 to 0·113 indicating the seasonal variations as observed by other workers (Kadam and Patil, 1933). Natural crosses were found in all directions and was not confined to any particular row indicating that the pollen had travelled in all directions. The per cent natural crossing in the first row at 1 foot from the pollen parent as well as 10 feet away from the pollen parent in the same direction appeared to be similar. More of natural crosses were found in the direction of North and East and this might have resulted due to the wind blowing towards that direction during November - December when the crop was in flower.

The per cent of natural crossing, however was low at Coimbatore during the main cropping season (July — January) when the medium and long maturity winter rices are grown. The spatial isolation between varieties to prevent natural crossing is as much as 10 feet and might exceed further.

Summary: At Coimbatore natural cross pollination in two winter rice varieties was estimated to range between 0·004 per cent to 0 113 per cent. It varied during the four years of experiments in the same two varieties. The distance between the pollinating parent and seed parent ranged from 1 foot to 10 feet.

TABLE 1 (a)

Natural crossing between Co. 12 and Co. 19 at Coimbatore 1956—'57.

Co. 12 Row No. which showed natural crosses	Direction	Total No. of plants studied	No. of plants with ripening brown in furrows	Percentage of natural crossing in each row
5	East	330	1	0·31
8	East	205	1	0·49
2	South	211	1	0·47
5	South	104	1	0·96
6	South	209	1	0·48
1	North	171	1	0·60
2	North	174	1	0·60
4	North	530	2	0·38
5	North	265	2	0·75
9	North	329	2	0·61
No. of plants that did not show natural crossing	East, West, North, South, S. W., N. E., S. E., N. W.	32,165	Nil	—
	Total	34,693	13	0·004

TABLE 1 (b) (1957—'58)

Co. 12 Row No. which showed natural crosses	Direction	Total No. of plants studied	No. of plants with ripening brown in furrows	Percentage of natural crossing in each row
1	South	285	2	0·70
4	South	209	1	0·48
2	West	212	1	0·47
3	West	322	2	0·62
8	West	358	2	0·56
9	West	336	1	0·30
Nil	East	—	—	—
Nil	North	—	—	—
No. of plants that did not show natural crossing	East, West, North, South, S. W., N. E., S. E., N. W.	7,330	Nil	—
	Total	9,052	9	0·009

TABLE 1 (c) (1958—'59)

Co. 12 Row No. which showed natural crosses	Direction	Total No. of plants studied	No. of plants with ripening brown in furrows	Percentage of natural crossing in each row
4	East	336	1	0·29
5	East	336	3	0·89
6	East	336	1	0·29
7	East	336	1	0·29
8	East	336	1	0·29
9	East	336	3	0·89
10	East	336	1	0·29
1	South	336	1	0·29
6	South	336	3	0·89
1	North	336	2	0·60
2	North	336	3	0·89
3	North	336	3	0·89
5	North	336	1	0·29
8	North	336	1	0·29
1	West	336	2	0·60
2	West	336	3	0·89
5	West	336	2	0·60
6	West	336	3	0·89
7	West	336	1	0·29
No. of plants that did not show natural crossing	East, West, North, South, S. W., N. E., S. E., N. W.	79,632	Nil	—
	Total	86,016	36	0·04

TABLE 1 (d) (1959—'60)

Co. 12 Row No. which showed natural crosses	Direction	Total No. of plants studied	No. of plants with ripening brown in furrows	Percentage of natural crossing in each row
1	East	147	6	4·08
3	East	147	1	0·68
4	East	147	1	0·68
7	East	147	1	0·68
8	East	147	1	0·68
9	East	147	3	2·04
10	East	147	2	1·36
2	South	147	2	1·36

TABLE 1 (d) 1959—'60 *(Contd)*

Co. 12 Row No. which showed atural crosses	Direction	Total No. of plants studied	No. of plants with ripening brown in furrows	Percentage of natural crossing in each row
3	South	147	1	0·68
9	South	147	1	0·68
2	North	147	2	1·36
3	North	147	1	0·68
4	North	147	1	0·68
5	North	147	2	1·36
6	North	147	2	1·36
8	North	147	1	0·68
9	North	147	1	0·68
10	North	147	1	0·68
1	West	147	1	0·68
2	West	147	2	1·36
3	West	147	2	1·36
10	West	147	2	1·36
No. of plants that did not show natural crossing	East, West, North, South, S. W., N. E., S. E., N. W.,	29,547	Nil	—
	Total	32,781	37	0·113

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