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EFFECT OF SPACING ON THE YIELD AND RIPENING OF RICE

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The investigation to determine the effect of size of spacing on the grain yield and ripening of rice cultivar Basmati-370 revealed that 20 x 20 cm plant spacing produced significantly higher paddy yield (4.18 t/ha) than 15 x15, 25 x 25, 30 x 30 and 40 x 40 cm spacings which yielded 3.78, 3.71, 3.47 and 3.20 t/ha, respectively. Narrower plant spacing significantly produced more sterility and opaque Kernels which were reduced by increasing plant spacing between hills and rows. The occurrence of abortive kernels was not affected significantly by the size of nutritional area.

INTRODUCTION

Among various factors responsible for boosting rice production, size of nutritional area or plant population is considered to be the key factor. If the spacing is decreased beyond the optimum level, yield is decreased due to mutual shading effect of leaves and greater compition amongst the plants for nutrients and water, which result in inefficient utilization of solar radiation. With the wider spacing, on the other hand decrease in number of plants per unit area also results in lower yields. Panikar *et al.* (1978), Venkates and Mahatim (1980), Balasubramaniyan (1985) and Ayub and Sharar (1980) found that spacing had non–significant effect on grain yield. Suleman (1982) concluded that narrower spacings of 15 x 15 cm gave significantly higher percentage of abortive and opaque kernels and more straw yield than 22 x 15 and 22 x 22 cm spacings while, 22 x 22 cm spacing gave significantly higher paddy yield than rest of the spacings. Chaudhry and Suleman (1983) concluded from a field trial that 22 x 22 cm plant spacing was the most suitable for increasing panicle bearing tillers and reducing sterility. Bari *et al.* (1984) reported that 20 x 20 cm yielded significatly more per plant than 15 x 15 and 25 x 25 cm spacings. Keeping these contradictory results in view, the present study was, undertaken to find out the appropriate size of the nutritional area to obtain the maximum yield of Basamati-370, a fine cultivar of rice.

MATERIALS AND METHODS

The investigations were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad. The experiment was quadruplicated in Randomized Complete Block Design with a net plot size of 6 x 6 meters. Rice cv. Basmat-370 nursery was sown in the 3rd week of June and seedlings were transplanted on 22 July at distances of 15 x 15, 20 x 20, 25 x 25,30 x 30 and 40 x 40 cm between hills and rows with an average of two seedlings per hill. Puddling was achieved two days before transplanting. Fertilizer was applied at the rate of 50 kg N + 25 Kg P_2O_5 per hectare. Whole of the P_2O_5 was applied at the time of transplanting, where as nitrogen was applied in two splits, 25 kg per hectare at the time of transplanting and rest 55 days after transplanting. All other agronomic operations were kept normal and uniform for all the treatments to observe the occurence of sterility (unfertilized flowers), abortivenees (flowers that get fertilized but stop growing during the early stage of kernel development and do not attain ful size), opaqueness (kernels that attain full size but do not become translucent due to lack of carbohydrates, the filling material during later stage of kernel development) and normal kernels (that attain full size, become translucent and show normal starch compaction in them). Ten panicles were selected at random from each experimental unit and sketched by using the standard method (Nagato and Chaudhry, 1969) with the help of common electric lamp and seed working board. Paddy and straw yield per plot was obtained soon after cutting and threshing the entire crop of net plot of each treatment in each replication. The yield was then calculated on hectare basis.

The data collected were analysed statistically using Fisher's Analysis of Variance Technique and Duncan's New Multiple Range Test was employed to test the significance of treatment means at 5% probability level (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Data given in Table reveals that the sterility percentage was influenced significantly by the size of nutritional area; 15 x15 cm plant spacing resulted in the maximum sterility and remained at par with 20 x 20, 25 x 25 and 30 x 30 cm spacings. Sterility percentage was reduced by increasing plant spacing between hills and rows. The increased sterility percentage with decreased inter-rows and intra-rows spacing might be due to hard competition among the sex primordia for assimilates on account of more plants per unit area on one hand and photosynthetic efficiency on the other because of mutual shading. Chaudhry and Suleman (1983) had also given similar results. Plant spacing between hills and rows did not affect significantly the occurrence of abortive kernels. However, there had been a linear decrease in abortive kernels with the increase in spacing above 15 x 15 cm. The maximum and minimum abotive kernels were produced by plants spaced at 15 x 15 and 40 x 40 cm, respectively. The increased abortiveness in plants grown at closer spacing might have been due to hard competition of photosynthates, causing abnormal kernels. These findings are in conformity with those of Suleman (1982).

The percentage of opaque kernels was influenced significantly by the size of nutritional area. Opaque kernels were reduced by increasing the plant spacing; 15 x 15 cm spacing produced significantly the maximum number of opaque kernels, while 40 x 40 cm spacing producing the minimum opaque kernels, remained at par with 30 x 30 cm. The spacings 30 x 30, 25 x 25 and 20 x 20 cm did not differ significantly from oneanother. The results are in agreement with those of Suleman (1982). It is clear from the Table that spacing influenced significantly the normal kernels; 40 x 40 cm plant spacing produced the maximum normal kernels, but remained at par with 30 x 30, 25 x 25 and 20 x 20 cm spacings.

The spacing 15 x 15 cm produced significantly the minimum normal kernels. On the other hand wider spacing produced more kernels which were less opaque, abortive or sterile. Similar results were reported by Mishra (1976). Yield depends upon individual plant performance as well as total number of plants grown per unit area. It can be deduced from the Table that paddy yield was affected significantly by spacing; 20 x 20 cm and 40 x 40 cm spacing, respectively gave significantly higher and lower paddy yield than rest of the spacing. Paddy yield decreased as the size of the nutritional area was increased beyond 20 x 20 cm. However, 15 x 15 and 25 x 25 cm plant spacing remained at par with each other. Although performance of individual plants grown in wider spacing was better as compared to the plants with 20 x 20 cm spacing, but higher population in 20 x 20 cm spacing could off set these effects thus increasing the net paddy yield, the spacing 15 x 15 cm had more plant density, but due to less fertile

Table . Effect of spacing on the mean yield and ripening of rice

Spacing	Sterility percentage	Abortive kernels	Opaque kernels	Normal kernel	paddy yield
15 x 15 cm	16.43* a	4.21	7.51 a	71.84 b	3.78 b
20 x 20 cm	10.18 b	2.43	6.58 b	81.23 a	4.18 a
25 x 25 cm	9.61 b	1.99	6.46 b	81.49 a	3.71 b
30 x 30 cm	8.54 b	1.93	6.04 bc	83.61 a	3.47 c
40 x 40 cm	8.14 b	1.80	5.48 c	84.45 a	3.20 d

* Means not sharing a letter in common differ significantly at 5% probability level

tillers per hill and more sterility than 20 x 20 cm produced less paddy yield. Similar results were reported by Bari *et al.* (1984), while contrary results were reported by Panikar *et al.* (1978), Venkates and Mahatim (1980) and Ayub and Sharar (1986) who reported non-significant effect on yield due to spacing.

REFERENCES

Akbar, M. and A. R. Saleemi. 1981. Increasing rice production through research, extension and farmers. Progressive Farming, 1(66) : 5-9. Pak. Agri. Res. Council, Islamabad.

Ayub, M. and M. S. Sharar. 1986. Growth and yield of rice cultivar IRRI-6 as influenced by planting density. Pak. J. Sci. Ind. Res. 29 (2): 123-125.

Balasubramaniyan, P. 1985. Management o f aged seedling of medium duration rices. IRRI. news letter, 10 (1) : 28-29. (Rice Absts., 8(10): 1768;1985).

Bari, G., G. Mustafa, A . M. Soomro, A . W. Baloch and K. H. Tahir. 1984. Effect of plantdensity on grain yield and yield components of different varieties and mutant strains of rice. Pak. J. Bot., 16(2): 169-174.

Chaudhry, F.M. and Suleman. 1983. Effect of plant spacings and nitrogen levels on the ripening and yield of rice. Pak. J. Agri. Sci., 20(3-4) : 140-145.

Mishra, G.N. 1976. Plant population studies in rice under fertilizer nitrogen constraint. Thesis, Govind Ballabh pant. Univ. of Agri. and Tech. Pantnagar India. (Field Crop Absts., 31 (8): 4628; 1978).

Nagato, K and F.M.Chaudhry.1969. A com parative study of ripening process and kernel development in Japonica and Indica rice. Proc. Crop. Sci. Soc. Japan, 38: 425-433.

Panikar, K. S., P. B. Pillai and P. Chandrasekharan. 1978. Influence of age of seedlings, spacing and time of application of nitrogen on the yield of rice Var. IR-8. Agri. Res. J. Keerala, 16 (2): 227-229.

Singh, B.K., R. B. Thakur and R. P. Singh. 1982. Effect of nitrogen levels and spacing on the perfomance of kharuhan rice. Ind. J. Agron., 27(3) : 310-312.

Steel, R.G.D. and J. H. Torrie. 1980. Principles and Procedures of Statistics. McGraw Hill Book Co.,Inc. New York.

Suleman, M. 1982. Effect of plant population and nitrogen on the growth and yield of rice. M.Sc. Agri. Thesis, Univ. of Agri., Faisalabad, Pakistan.

Venkates, W. M. S. and S. Mahatim. 1980. Response of rice varieties to different spacings and fertility level on yield attributes and yield. Ind. J. Agron., 25 (2): 263-267. (Field Crop Absts., 34 (9): 7087;1981).