A technical analysis of high yields of rice in Mandya district of India

Mandya district in a southern part of Mysore State is located on the Deccan Plateau, at an elevation of 700 m. The highest monthly maximum temperature is 35°C in March and April while the lowest monthly minimum temperature is 15°C in December and January. Diurnal variations of temperature are as large as 15°C, a characteristic of plateau climate. Annual precipitation, distributed mainly from April to November, is about 700 mm, with 65 rain days. Relative humidity is around 50%. Soils are granite origin, ranging from sandy loam to loam with pH of about 6, except low-lying areas where soil pH is often 8, causing alkali and salt damages.

There are two rice seasons; dry season crop (summer crop from January to May), and wet season crop (Kharif crop from June to December). Even in Kharif, rice is irrigated with water from the Krishnarajasagar Dam, as rainfall alone is not sufficient. Solar radiation during crop seasons is plentiful. Thus, the general climatic condition is very favourable for rice cultivation.

In 1970 a field survey was conducted on a total of 54 farm plots, which consisted of 18 plots each from high-yielding, medium-yielding and low-yielding areas of the district. As given in Table 1, not only high-yielding varieties like IR 8 and Manila which were introduced recently to farmers, but also local improved varieties were found giving strikingly high yields.

The analysis of yield components indicated that such high grain yields were attributed to a large number of spikelets produced per unit field area (hereafter refers to spikelets/m²). The relation between grain yields and spikelets/m² is shown in Fig. 1 for IR 8 and a local variety, S 701. The grain yields increased linearly with an increasing spikelets/m² up to 60,000 spikelets with IR 8, and 50,000 spikelets with S 701. Beyond that points, the yield

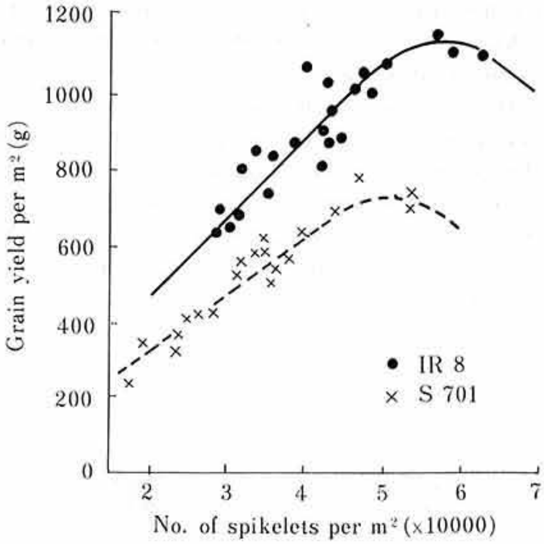

Fig. 1. Relation between number of spikelets/m² and grain yield

Table 1. Grain yields and yield-components on farmers' fields

	IR 8	Manila	BAM 3	S 701	Rajabhoga	Others
Grain yield (kg/ha)	8, 293	7, 957	5, 038	5, 048	5, 123	5, 256
No. of panicles/m²	461	440	361	377	289	363
No. of spikelets/panicle	90	106	78	94	129	103
No. of spikelets/m² (×1, 000)	41	48	28	35	38	36
Percentage of ripened grains (%)	71	70	82	77	82	75
Weight of 1, 000 ripened grains (g)	29	24	22	19	17	20
Weight of straw (kg/ha)	7, 530	9, 770	4, 670	5, 720	6, 420	6, 150

Note: 1) No. of plots surveyed for each variety was 19 for IR 8, 3 for Manila, 4 for BAM 3, 19 for S 701, and 3 for Rajabhoga

2) With other varieties: 1 plot for Indrabhoga, 1 for Garuda-Kemboothi, 2 for S 1092, 1 for Jadesanna, and 1 for Devamallige

tended to decrease due to the lowering of ripening factor (yield per 1,000 spikelets).

It has been recognized that the major reason for low yields of rice in Southeast Asia can be attributed to the low spikelets/m². For example, in Malaysia, which shows the highest yields in Southeast Asia, an average yield in 1967 was 2.25 ton/ha. Assuming that 1,000 paddy weight is 20 g, and the percentage of ripened grains is 70%, the spikelets/m² is calculated to be only 16,000, far less than that found in Mandya.

How could such high spikelets/m² be obtained in Mandya district? The salient characteristic of rice cultivation in this district is dense planting. As shown in Fig. 2, the planting density on farmers' fields ranged from 30 to 78 hills/m² for IR 8, and 25 to 51 hills/m² for S 701.

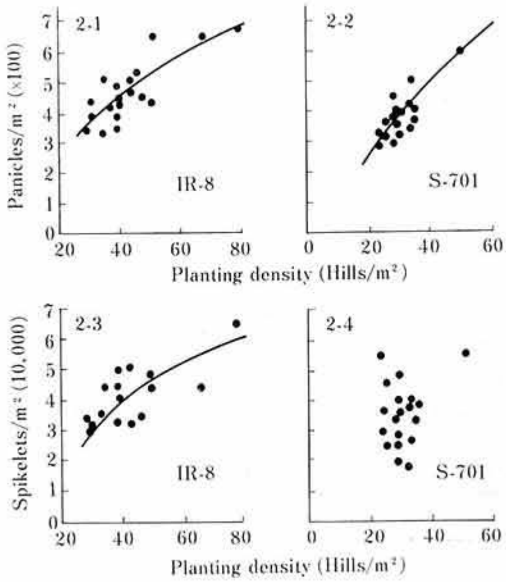

Fig. 2. Effect of planting density on number of panicles/m² and spikelets/m²

An increase in planting density resulted in an increased number of panicles/m² with both varieties. Spikelets/m² was also increased with IR 8, but not with S 701. With the latter variety, an increased number of panicles caused a decrease in the number of spiklets produced per panicle. Even with IR 8, the yield per 1,000 spikelets (ripening factor) showed a decrease with an increasing spikelets/m² (Fig. 3). These results indicate that an optimum planting density does exist for each variety.

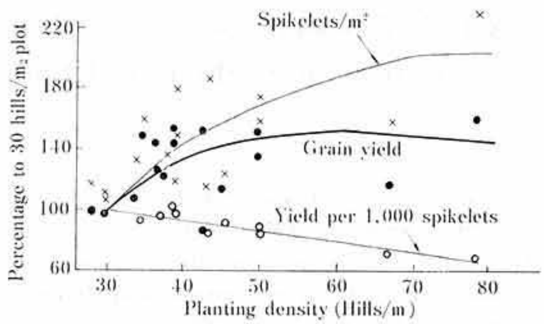

Fig. 3. Relation between planting density and grain yield, yield per 1,000 spikelets and number of spikelets/m² (IR 8)

Fig. 3 gives the highest yield of IR 8 at the planting density of 60 hills/m². However, a density of 50 hills/m² can be regarded practically optimum, because no appreciable yield increase occurs beyond 50 hills/m². This is the government recommendation for IR 8 in this district.

The effect of planting density on grain yields was not so clear with S 701 as IR 8, because (1) as stated above, higher density did not always cause an increased spikelets/m², and (2) densities on farmers' field were within a narrow range around 30 hills/m², a recommended planting density for S 701. Nevertheless, it can be said that the densities around 30 hills/m² are very high as compared with that observed elsewhere in Southeast Asia.

Such a high density effect as observed in Mandya district seems to be caused by a favourable climate such as plentiful solar radiation and large diurnal variations of temperature.

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