

Certain Agronomic Practices Contributing to Higher Yield in Rice

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Introduction : Of late, in an effort to attain self sufficiency in rice production in our State there have been various attempts to explore the possibilities of increasing the acre yield by adopting Japanese and other improved methods of rice cultivation. Trials have been conducted in various Research centres in India to assess the exact contribution of some of these methods like planting in lines and giving wider spacing between plants, intercultivation with interculturators or working weeders between rows of standing crop, heavy application of manures like cattle manure, compost or green leaf and fertilizers like ammonium sulphate and super phosphate. In this paper the results of trials conducted at the Agricultural Research Station, Pattambi, Malabar with special reference to some of these aspects are reviewed.

Materials and methods : Four different observations as indicated below were made to assess the exact contribution of the above factors in the shape of experiments and observation plots.

(1) An experiment to 'Compare the merits of the Japanese method and the Farm method,' was laid out during the cropping seasons of 1953, 1954 and 1955. The main features of Japanese method are: (1) raised nursery beds in long and narrow strips to facilitate weeding, (2) manuring the seed bed with cattle manure at 40 cart loads plus wood ash at 2,000 lb. plus compost at 2,000 lb. per acre and a mixture of ammonium sulphate and super phosphate at 1 : 1 ratio at 2 lb. for every pound of seed sown, (3) treating the seed with salt solution, (4) sowing at $1\frac{1}{2}$ lb. of seed per cent of nursery, (5) applying a second dose of manure equal to the first dose after sowing, (6) manuring the transplanted field with 20 cart loads of farm yard manure plus 30 lb. phosphoric acid as basal dressing and 15 lb. nitrogen and 15 lb. P_2O_5 in the form of ammonium sulphate and superphosphate respectively 30 days after planting and another similar dose 30 days after, and (7) transplanting in rows with a spacing of 10" × 10" and interculturing with rotary weeder at intervals of 15 days till two weeks before flowering. The farm method consisted of: (1) manuring the wet seed bed with 10,000 lb. of green

manure per acre, (2) using 3 lb. of seed per cent of nursery, (3) manuring the transplanted field with a basal dressing of 5,000 lb. green leaf per acre and 30 lb. P_2O_5 as superphosphate at the time of last ploughing and 30 lb. nitrogen as ammonium sulphate 3 to 4 weeks after transplanting and (4) transplanting 6" x 6" bulk. The varieties PTB 2 and PTB 9 in the first crop and PTB 18 and PTB 20 in the second crop were under trial. The data are presented in Table I.

TABLE I
Size of sub plot 30'x25'
Lay out 4x8 Randomised.

Treatments	1st crop		2nd crop					
1. Japanese method	PTB 2		PTB 18					
2. Farm method	PTB 2		PTB 18					
3. Japanese method	PTB 9		PTB 20					
4. Farm method	PTB 9		PTB 20					
First Crop.								
	PTB 2		PTB 9		G. M.	S. E.	"Z" Test satisfied or not	C. D.
	(Jap) 1	(Farm) 2	(Jap) 3	(Farm) 4				
<i>Grain Yield in lb.</i>								
Acre yield								
1953-54	2843	1818	2654	1578	2253	102.25	Yes	213
1954-55	3031	2516	1951	1940	2359	96.25	Yes	200
1955-56	2777	2464	2500	2142	2471	73.67	Yes	217
% on G. M.								
1953-54	127.9	81.8	119.4	70.9	100	4.60		9.6
1954-55	128.5	108.7	82.7	82.2	100	4.08		8.5
1955-56	112.4	99.7	101.2	86.7	100	2.98		8.8
Conclusion:								
	1953-54	1	,	3	,	2	,	4
	1954-55	1	,	2	,	3	,	4
	1955-56	1	,	3	,	2	,	4
<i>Straw Yield in lb.</i>								
Acre yield								
1953-54	3330	2094	2436	1447	2327	90.8	Yes	189
1954-55	5779	3044	4428	2760	4155	274.0	Yes	814
1955-56	3376	4539	2768	3286	3492	100.9	Yes	296
% on G. M.								
1953-54	143.1	90.0	104.7	62.2	100	3.9		8.1
1954-55	139.1	87.7	106.6	66.6	100	6.6		19.6
1955-56	96.7	130.0	79.3	94.1	100	2.8		8.5
Conclusion:								
	1953-54	1	,	3	,	2	,	4
	1954-55	1	,	3	,	2	,	4
	1955-56	2	,	1	,	4	,	3

TABLE I (Contd.)

Economics of Cultivation.

	PTB 2		PTB 9	
	(Jap)	(Farm)	(Jap)	(Farm)
	<i>Profit per Acre.</i>			
1953-54	Rs. 360-6-0	221-4-0	298-4-0	144-12-0
1954-55	„ 335-9-0	266-2-0	140-14-0	161-4-0
1955-56	„ 62-14-0	208-6-0	4-6-0	136-11-0

Second Crop.

	PTB 18		PTB 20		G. M.	S. E.	"Z" Test satisfied or not	C. D.	
	(Jap) (1)	(Farm) (2)	(Jap) (6)	(Farm) (4)					
	<i>Grain Yield in lb.</i>								
Acre yield									
1953-54	..	..	FAILED		..	..	..	..
1954-55	2592	2301	3049	2737	2669	64.1	Yes	133.2	
1955-56	..	..	FAILED		..	..	..	..
% on G. M.									
1954-55	97.1	86.2	110.4	102.0	100	2.4		4.9	
Conclusion:									
	1954-55		3		4		1		2

Straw Yield in lb.

Acre yield									
1954-55	2788	2265	3281	2403	2684	137.3	Yes	273.1	
% on G. M.									
1954-55	103.8	84.4	122.2	89.5	100	6.5		13.6	
Conclusion:									
	1954-55		3		1		4		2

Economics of Cultivation.

	PTB 18		PTB 20	
	(Jap)	(Farm)	(Jap)	(Farm)
	<i>Profit per Acre.</i>			
1954-55	Rs. 208-8-0	234-1-0	299-6-0	312-7-0

(2) A regular replicated randomised trial was conducted in the first and second crop seasons of 1955 to find out 'the effect of interculture on the yield.' The crop was planted in lines 10" x 6" with 4 seedlings per hole in the plots receiving interculture and 6" x 6" bulk in the normal method. Interculture with double row rice weeder and ordinary weeding were done in different plots planted in lines whereas in the bulk planted plots, hand weeding alone was done. Apart from recording the yield, economics of cultivation were also worked out for each method. Data are tabulated in Table II.

TABLE II
Trial with double row rice weeder.

Lay out: 3x8 Randomised blocks.

- Treatments:
1. Planting in bulk 6"x6" spacing with two seedlings per hole and hand weeding (control)
 2. Planting in lines 10"x6" spacing with 4 seedlings per hole and hand weeding.
 3. Planting in lines 10"x6" spacing with 4 seedlings per hole and double row rice weeder worked every fortnight.

	<i>First crop</i>	<i>Second crop</i>
Variety planted	PTB 2	PTB 20
Sown on	23-4-55	5-9-55
Planted on	16-6-55	2-11-55
Harvested on	12-10-55	24-1-56
No. of times the weeder worked	4 times	2 times

Summary of results

First Crop

	1	2	3	G. M.	S. E.	'Z' Test	C. D.
Acre yield in lb.	3086	3370	3243	3234	45.6		138.3
Percentage on control	100.0	109.2	105.1	104.8	1.48	Satisfied	4.48

Conclusion: 2, 3, 1

Second Crop

	1	2	3	G. M.	S. E.	'Z' Test	C. D.
Acre yield in lb.	2396	1089	1519	1843	72.46		219.8
Percentage on control	100.0	70.46	64.71	77.0	3.28	Satisfied	9.83

Conclusion: 1, 2, 3

Economics.

Particulars	Treatment 1		Treatment 2		Treatment 3	
	1st crop	2nd crop	1st crop	2nd crop	1st crop	2nd crop
Yield of grain per acre in lb.	3086	2396	3370	1689	3243	1549
Yield of straw per acre in lb.	4467	3621	4381	3268	4419	3240
Value of produce per acre.	497-6-0	390-0-6	530-12-6	292-12-6	515-13-6	274-10-0
Cost of cultivation excluding interculture or weeding.	114-3-0	115-8-0	116-0-0	118-0-0	116-1-0	118-0-0
Cost of intercultural or weeding.	5-10-0	5-0-0	5-10-0	5-0-0	12-0-0	6-0-0
Total cost of cultivation.	119-13-0	120-8-0	121-10-0	123-0-0	128-0-0	124-0-0
Profit per acre.	377-9-0	269-8-6	269-8-6	169-12-6	387-12-6	150-10-0

(3) During the second crop season of 1955 an experiment was laid out to find out 'the effect of interculture by working rotary weeder and hand rake against the ordinary hand weeding on the yield of paddy' under normal and heavy manuring as per Japanese method. Details of experiment and data are given in Table III,

TABLE III
Interculture Experiment on Rice

Lay out: 10 x 4 Rand blocks.

Sown on: 5-9-1955

Planting: 10" x 10", 4 seedlings per hole.

Planted on: 7 & 8-11-1955

Variety planted: PTB 20.

Harvested on: 30-1-1956.

Treatment:

- 1-5 Japanese manuring: Green leaf 6,000 lb. per acre.
Cattle-manure 5 cart-loads.
Ammonium Sulphate 100 lb. per acre applied at the time of planting and an equal quantity one month after planting.
- 6-10 Madras manuring: Green leaf 5,000 lb. per acre. } Basal dressing.
Super 150 lb. per acre. }
Ammonium sulphate 150 lb. per acre — top dressed one month after planting.

- Treatments:
1. Interculture by rotary weeder 15 days, 30 days and 45 days after planting.
 2. Interculture by hand rake — 15 days 30 days and 45 days after planting.
 3. Weeding twice 15 days, and 30 days after planting each followed by one interculture by rotary weeder.
 4. Weeding twice only.
 5. No weeding and no transplanting.
 6. As in (1).
 7. As in (2).
 8. As in (3).
 9. As in (4).
 10. As in (5).

TABLE 3 (Contd.)
Summary of Results
Grain Yield per acre

Treatments Particulars	1	2	3	4	5	6	7
Acre yield in lb.	679	752	705	862	745	631	704
Percentage on control	83.3	92.3	86.52	105.8	91.4	77.4	88.4
Percentage on general mean	93.7	103.8	97.22	119.0	102.8	87.10	97.18
Treatments Particulars	8	9	10	G. M.	S. E.	'Z' test C.D.	
Acre yield in lb.	669	814	671	724	36.9	Not satisfied	
Percentage on control	82.2	100.0	82.4	88.9	4.5		
Percentage on general mean	98.42	112.4	73.5	100.0	5.09		

(4) During the second crop season of 1955-'56 each of the seven strains was planted in lines 12" x 6" in small plots with a view to undertake thorough and easy roguing and purification to serve as nucleus seeds for sowing on the station next year. The yields from these plots were recorded separately and were compared with the yields of the same strains planted in the usual way, i. e., as bulk with a spacing of 6" x 6". The data are presented in Table IV.

TABLE IV
Normal planting vs. planting in lines with wider spacing

Strain No.	Normal planting in bulk 6" x 6"		Line planting with 12" x 6" spacing	
	Area in acres	Yield in lb. per acre	Area in acres	Yield in lb. per acre
PTB 12	3.49	2,809	0.30	3,246
PTB 16	1.14	2,744	0.16	2,608
PTB 18	3.71	1,978	0.26	2,516
PTB 20	4.28	1,040	0.18	511
PTB 21	0.42	2,078	0.26	1,513
PTB 27	3.25	2,727	0.20	2,055
Arikirai culture	1.48	1,447	0.27	1,253

Discussion: The experiment to compare the Japanese method of rice cultivation with the Farm method was conducted for three years since 1953 in the first and second crop seasons. It is seen from the results (Table I) that in all the four seasons, two seasons having failed, the yields of grain and straw in the Japanese method were

consistently higher than in the Farm method except in the first crop of 1955 when the Japanese method gave less yield of straw than the Farm method. However, the economics show that net profit per acre had often been more with the Farm method than with the Japanese method.

From the results of the experiment with double row rice weeder (Table II) it is seen that no increased yield was obtained due to the working of the implement. The normal method of hand weeding has been found not only to be efficient and economical but also profitable when compared with interculture by double row rice weeder. The crop planted in lines with wider spacing in the first crop with strain PTB 2 has given much higher yield than that planted bulk with normal spacing due [to its lodging habit while in the second crop with the strain PTB 20 which does not lodge, the results were reversed, the yield being lower in the crop planted in lines with wider spacing than that planted bulk.

In the interculture experiment (Table III) where all the treatments were planted in lines 10" × 10", the control plot which received normal cultivation, i. e., hand weeding has given the highest yield under both normal and heavy manuring conditions, indicating that interculture by hand rake or rotavator by no means increases the yield.

Finally from the data in Table IV, it was observed that certain strains planted in lines with wider spacing gave higher yields than the same planted in bulk while in certain other strains the position is reversed. It was also noted that PTB 18 planted bulk had lodged partially or totally at different periods after flowering while the strains planted in lines 12" × 6" had not lodged. On the other hand the strains PTB 16, PTB 20, PTB 21, PTB 27 and Arikirai culture had not lodged even at the time of harvest both in bulk as well as in the area planted in lines with wide spacing. The indications are that for the strains which lodge easily, wider spacing may be preferred as in the case of PTB 12 and PTB 18 which have given higher yields when planted in lines with wider spacing. But in the case of strains which do not lodge, closer planting may be adopted to get the maximum yield. It is generally seen that heavy manuring of the rice crop usually predisposes the crop to lodging due to the luxuriant vegetative growth. In such cases planting in lines with wider spacing as followed in the Japanese method of cultivation will be advantageous.

Summary and Conclusion: From the observations and trials briefly described above it is seen that; (1) Excessive manuring for rice crop does not give commensurate profit; (2) Interculture in the standing crop either by rotavators or by hand rake does not contribute to increased yield in rice under Malabar conditions. Ordinary hand weeding is superior to interculture in respect of yield and profit, (3) Planting with wider spacing is advantageous in the case of lodging varieties of rice while closer spacing is to be preferred with the varieties of rice which do not lodge.

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- Page 548 Under award of M. Sc. Degrees :
1. In the second line read "there is" as "thesis".
 2. Line 5. Read "Biananics" as "Bionomics".
- Page 564 Para 1. Line 9. Read "Sum" as "some".
- Page 566 Fig. 1. The words "Sprayod" and "Control" to be interchanged.