RÔLE OF BLUE-GREEN ALGAE AND DIFFERENT METHODS OF PARTIAL SOIL STERILIZATION ON RICE YIELD

By R. Subrahmanyan, F.A.Sc., L. L. Relwani and G. B. Manna

(*Central Rice Research Institute, Cuttack*)

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Introduction

The rôle of blue-green algae in combination with lime, superphosphate and sodium molybdate and partial soil sterilization as well as organic manures, etc., on rice yield was reported earlier (Relwani and Subrahmanyan, 1963; Relwani and Manna, 1964; Subrahmanyan *et al.*, 1964 *a* and *b*). In the present study, the rôle of a known species, *Nostoc sphaericum*, with different methods of partial soil sterilization was first investigated under pot house conditions in the second crop season (December–April) of 1962–63. The experiment was again repeated in the next crop season (July–December) of 1963 as well as in the succeeding season. The main object was to study the cumulative residual effect of algal treatments as also of partial soil sterilization.

Methods

Partial soil sterilization treatments as well as a basal dressing of lime at 500 kg./ha., superphosphate at 20 kg./ha., P_2O_5 and sodium molybdate at 0·28 kg./ha. for all the treatments were given only once at the beginning while algal inoculation was repeated for two seasons only at about 2 gm. dry weight per hectare (·004 mg. alga per pot). Partial soil sterilization methods consisted of steam heating in an autoclave for 20 minutes at 20 lb. pressure, treatment of the soil with formaldehyde and *rabbing* (heating top soil by burning a two-inch layer of dried cow-dung cake). The ash formed in the last treatment was carefully collected and thrown away to prevent enrichment of the soil by the ash constituents. To determine the relative responses from the different treatments in terms of nitrogen, ammonium sulphate was applied at four levels, *viz.*, 20, 40, 60 and 80 kg. N/ha. Paddy varieties *Ptb 10* and *C.R. T 141* were grown as test crops in the second and main crop seasons respectively.

RESULTS AND DISCUSSION

The yield of grain and straw and growth attributes relating to the experiments during the three seasons are presented in Tables I and II.

In the first instance (1962–63, II crop), application of algae to treatment, check, increased the grain yield by 19·7%, but this increase was not statistically significant. It may be observed that, under pot house conditions, check, 20 kg. N/ha. and 40 kg. N/ha. treatments did not differ significantly among themselves. Treatment check + algae produced a response which was *at par* with 60 kg. N/ha.

The autoclave, formaldehyde and *rabbing* treatments increased the grain yields by 126·6%, 78·5% and 21·1% respectively, the first two being statistically superior to the control. The alga produced a non-significant effect on the first two treatments; probably, the effect of the treatments themselves was so high that the effect of the alga was masked. Both the treatments were *at par* with 80 kg. N/ha. *Rabbing* effect, which was not significant over check, became significant in combination with the alga.

In the succeeding season (main crop of 1963, var. *C R. T 141*) application of the alga to check produced a significant 64·7% increase in grain yield. This appears to be due to the cumulative effect produced by the alga. The residual effects of partial soil sterilization by autoclaving, formaldehyde and *rabbing* were of the order of 141·4%, 75·0% and 75·3% respectively. Thus the beneficial effect of partial soil sterilization is seen maintained for two successive seasons (Table I). Higher response to residual effect of *rabbing* in the main season, besides varietal effect, could also be due to the strengthening of the indigenous flora as some of the potential competitors had been eliminated by the *rabbing* earlier.

The three partial soil sterilization treatments, in combination with alga, produced slight non-significant increases in yield, the autoclave + alga treatment bieng significantly superior to 80 kg. N/ha. treatment. Other treatments, including check + alga, were *at par* with 80 kg. N/ha. The straw yields followed practically the same pattern as grain yields. The increases in the yields were reflected in such growth attributes as height of shoot, number of effective tillers and length of panicles (Table II).

In the next season (1963–64, II crop) again, the yield data revealed the residual fertility build-up of the soil as a result of the alga inoculation. A grain yield of 74·3% over the no-alga check was obtained. It is also seen that there is a progressive increase in the response to grain yield in the algal treatments:

TABLE I

Yields of paddy grain and straw (gm. per pot). Average of three replications

Treatment	1962–63 (Second season crop) Variety—*Ptb.10*				1963 (Main season crop) Variety—*T.141*				1963–64 (Second season crop) Variety—*Ptb.10*			
	Grain		Straw		Grain		Straw		Grain		Straw	
	A	B	A	B	A	B	A	B	A	B	A	B
Check (only basal application)	5·22 (..)	6·25 (19·7)	4·96 (..)	6·36 (28·2)	6·57 (..)	10·82* (64·7)	8·00 (..)	15·80* (97·6)	4·83 (..)	8·42* (74·3)	4·50 (..)	8·07* (79·3)
Autoclave (Partial soil sterilization)	11·83* (126·6)	11·76* (125·3)	12·55* (153·0)	11·91* (140·1)	15·86* (141·4)	17·60 (167·9)	30·00* (275·1)	27·7* (246·3)	7·50 (55·3)	11·45* (137·1)	6·77 (50·4)	9·75* (116·7)
Formaldehyde (Partial soil sterilization)	9·32* (78·5)	9·53* (82·6)	9·10* (83·5)	9·86* (98·8)	11·50* (75·0)	12·58* (91·5)	18·80* (135·0)	22·2* (177·5)	5·90 (22·2)	7·10 (47·0)	5·18 (15·1)	6·02 (33·8)
Rabbing (Partial soil sterilization) (Surface heating of soil)	6·32 (21·1)	8·48* (62·5)	6·35 (28·0)	8·50* (71·4)	11·52* (75·3)	12·83* (95·3)	17·00* (112·5)	21·7* (171·3)	5·15 (6·6)	8·40* (73·9)	3·80 (−15·6)	7·28* (61·8)
20 kg. N/ha. as ammoniam sulphate	7·02 (34·4)	..	7·23* (45·8)	..	7·23 (10·0)	..	11·00 (37·5)	..	5·35 (10·8)	..	4·70 (4·4)	..
40 kg. N/ha. as ammonium sulphate	7·65 (46·6)	..	7·88* (58·9)	..	9·20 (40·0)	..	14·70* (83·8)	..	5·62 (16·4)	..	5·10 (13·3)	..
60 kg. N/ha. as ammonium sulphate	8·60* (64·8)	..	9·35* (88·5)	..	11·68* (77·8)	..	15·20* (90·1)	..	6·17 (27·7)	..	5·83 (29·6)	..
80 kg. N/ha. as ammonium sulphate	9·50* (82·0)	..	10·76* (116·9)	..	13·38* (103·7)	..	24·5* (206·3)	..	5·57 (15·3)	..	5·07 (12·7)	..
C.D. at 5% ..	2·91		2·054		4·21		4·40		2·78		2·56	

A—Without Blue-Green Algae; B—With Blue-Green Algae.
* Significant at 5% over 'check' treatment. Figures in brackets indicate per cent. increase over 'check' treatment.

TABLE II

Observation on height and effective tillers at harvest (Average of three replications)

Treatment	1962-63 (Second season crop) Variety—*Ptb. 10*				1963 (Main season crop) Variety—*T. 141*				1963-64 (Second season crop) Variety —*Ptb. 10*			
	Height (cm.)		Effective tillers per pot		Height (cm.)		Effective tillers per pot		Height (cm.)		Effective tillers per pot	
	A	B	A	B	A	B	A	B	A	B	A	B
Check (only basal application)	77·01 (..)	85·40 (10·9)	5·00 (..)	6·33 (26·4)	107·68 (..)	113·80 (5·6)	4·33 (..)	6·67 (54·2)	68·9 (..)	80·9 (17·4)	4·67 (..)	9·00 (92·7)
Autoclave (Partial soil sterilization)	101·10 (31·3)	100·16 (30·1)	9·33 (86·4)	9·33 (86·4)	125·08 (16·2)	119·90 (11·4)	10·67 (146·8)	12·67 (193·1)	80·0 (16·1)	85·7 (24·4)	6·67 (42·8)	9·00 (92·7)
Formaldehyde (Partial soil sterilization)	90·70 (17·8)	90·60 (17·6)	6·33 (26·4)	8·00 (60·0)	120·33 (11·9)	124·48 (15·6)	7·33 (69·4)	7·33 (69·4)	78·0 (13·2)	81·7 (18·6)	5·33 (14·1)	5·67 (21·4)
Rabbing (Partial soil sterilization) (Surface heating of soil)	81·40 (5·7)	87·36 (13·4)	5·67 (13·2)	6·67 (33·2)	119·2 (10·8)	119·76 (11·2)	6·00 (38·9)	9·00 (108·3)	76·8 (11·5)	82·0 (19·0)	4·33 (−7·3)	7·33 (56·9)
20 kg. N/ha. as ammonium sulphate	85·23 (10·7)	..	5·67 (13·2)	..	112·2 (4·2)	..	6·00 (38·9)	..	78·6 (13·2)	..	5·00 (7·1)	..
40 kg. N/ha. as ammonium sulphate	90·93 (18·1)	..	6·33 (26·4)	..	119·0 (10·5)	..	7·00 (62·0)	..	75·5 (9·6)	..	5·33 (14·1)	..
60 kg. N/ha. as ammonium sulphate	84·76 (10·1)	..	6·33 (26·4)	..	121·96 (13·3)	..	5·67 50·0	..	78·5 (13·9)	..	6·00 (28·5)	..
80 kg. N/ha. as ammonium sulphate	90·4 (17·4)	..	6·33 (26·4)	..	122·33 (13·6)	..	7·00 (62·0)	..	75·5 (9·6)	..	6·33 (35·5)	..

A—Without Blue-Green Algae; B—With Blue-Green Algae.
Figures in brackets indicate per cent. increase over 'check' treatment.

19·7%, 64·7% and 74·3% respectively during 1962–63 second crop, 1963 main crop and 1963–64 second crop seasons.

In the initial stages, though the response to partial soil sterilization treatments themselves was highly significant, the effect diminished in the succeeding seasons to non-significant levels, while the alga inoculation in combination with these treatments continued to maintain the fertility, obviously by their rôle in nitrogen fixation and addition of organic matter (Subrahmanyan and Sahay, 1964).

The above results would also indicate, as suggested earlier by Subrahmanyan and Sahay (*l.c.*) that blue-green algae in combination with non-nitrogenous fertilizers such as lime, superphosphate and trace of sodium molybdate could be an effective substitute for nitrogenous fertilizers like ammonium sulphate and, in fact, superior to it, particularly under low fertility status of the soil.

Summary

Results of experiments during three consecutive seasons on the rôle of blue-green algae in combination with partial soil sterilization and chemical nutrients indicate high responses to algae inoculation and a fertility build-up of the soil. It is also seen that blue-green algae tend to produce better response in soils which are poor.

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