ROLE OF BLUE-GREEN ALGAE, CHEMICAL NUTRIENTS AND PARTIAL SOIL STERILIZATION ON PADDY YIELD

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In an earlier account,[1] the possibilities of increasing paddy yield by inoculation of nitrogen-fixing blue-green algæ were indicated Intensive work was further undertaken in pot house and field in 1962 on *Main season* crop (July-November) to study the rôle of indigenous and the introduced forms of blue-green algæ in combination with chemical nutrients and partial soil sterilization. Medium duration variety T. 141 was used.

The treatments consisted of (*i*) inoculation with blue-green algæ (*Anabœna* sp. in pots and mixture of *Anabœna, Nostoc, Microcystis, Phormidium* and *Aphanothece* in the field), (*ii*) partial soil sterilization (20 lb. pressure for 1 hour in autoclave in pots and heating of top soil by burning straw on ploughed land in field) and (*iii*) application of nutrient mixture consisting of lime (1,000 Kg./ha.), superphosphate (20 Kg. P_2O_5/ha.) and sodium molybdate (0·28 Kg./ha.). Ammonium sulphate at 20 Kg./ha. was used as one of the treatments to compare the yield response in terms of this popular fertilizer for paddy.

About one gram of *Anabœna* alga in vegetative stage was collected from G Block of Central Rice Research Institute and paddy pots of Cytogeneticist. It was diluted with water immediately after collection. A portion of this was then put into wide-mouthed one pound screw-capped cylindrical bottles, filled to ¾ capacity, and shaken vigorously till a homogeneous suspension was formed. This process was repeated 7-8 times and the contents were transferred into 2,500 ml. winchester bottle. After a final vigorous shaking in this bottle for a uniform mixing, 100 ml. aliquots were poured in the required pots after transplanting in the pot house. A similar second application was given to the pots a fortnight after the first one. In the field, blue green moist scrapings along with surface soil, consisting of *Anabœna, Nostoc, Microcystis, Phormidium* and *Aphanothece*, were collected from all over the campus of the Central Rice Research Institute, thoroughly mixed into a homogeneous mass and weighed in lots of 500 gm. Each of such samples was then thoroughly mixed in a bucket of water and sprinkled uniformly in each of the required plots. The bucket was rinsed with water twice and the washings applied in a similar manner.

The precautions taken in the conduct of field experiment have been reported in the previous communication.[1] Yields of paddy, grain and straw in pots and field are given in Table I and pot experiments illustrated in Figs. 1 and 2.

TABLE I

Yields of paddy grain and straw

Treatment	Pots (gm. per pot). Average of five replications				Field (Kg per hectare). Average of four replications			
	Grain	Straw	per cent. increase over control		Grain	Straw	per cent. increase over control	
			Grain	Straw			Grain	Straw
A – Control (untreated) ..	10·43	14·25	..	..	2379·47	3795·91	..	..
B – Soil Sterilization ..	29·34	41·72	181·30	192·77	2857·82	4560·97	20·10	20·15
C – *A* + algæ ..	10·81	16·09	3·64	12·91	2578·39	4060·74	8·36	6·98
D – *B* + algæ ..	27·04	34·82	159·25	144·35	2977·87	4796·58	25·15	26·36
E – Lime + Superphosphate + Sodium molybdate (without soil sterilization)	11·03	14·05	5·75	–1·42*	2942·00	4766·95	23·64	25·58
F – Lime + Superphosphate + Sodium molybdate (with soil sterilization)	33·81	43·86	218·89	207·79	3489·41	5649·72	46·65	48·84
G – *E* + algæ ..	15·67	24·85	50·24	74·39	3441·15	5561·44	44·62	46·51
H – *F* + algæ ..	39·17	47·12	275·46	276·28	3661·25	5826·27	53·87	58·04
I – Ammonium sulphate at 20 Kg./hectare	11·30	18·07	8·34	26·81	3002·59	4825·80	26·19	27·13
S. Em. ..	±1·49	±2·64	..	..	±47·83	±118·17	..	..
C.D. at 5% ..	4·20	7·58	..	..	189·27	263·47	..	..

(* Per cent. decrease over control.)

It will be seen that: (1) The effect of blue-green algæ alone (Treatment C) was small, *i.e.*, 3·64% grain and 12·91% straw in pots and 8·36% grain and 6·98% straw under field conditions over untreated control (Treatment *A*). in pots and 44·62% grain and 46·51% straw in the field. This combination was significantly superior to nutrient mixture or algæ applied separately. Thus, chemical nutrients like lime, superphosphate and sodium molybdate appear

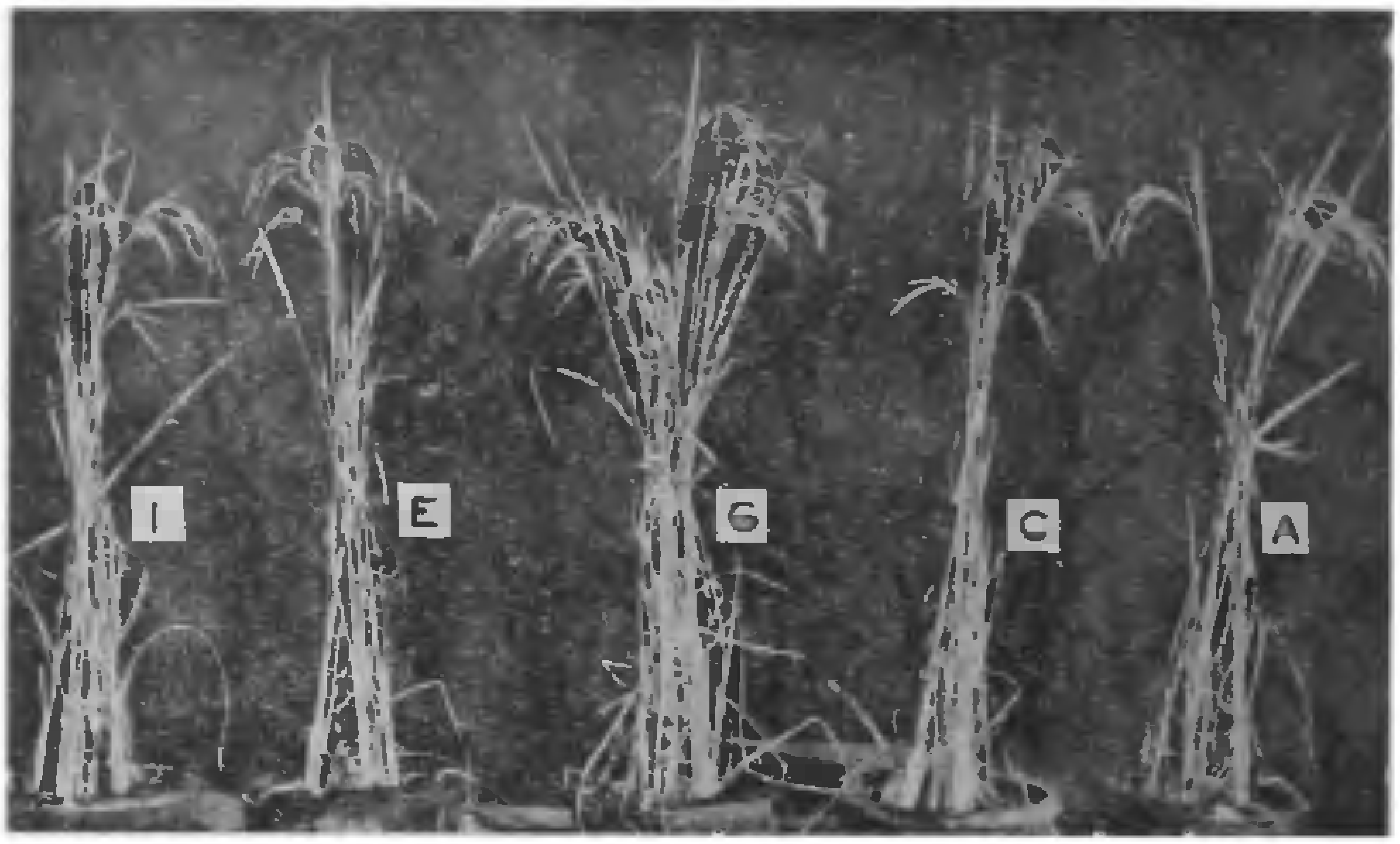

FIG. 1. Photograph of pot culture experiment. Treatments: *I*, Ammonium sulphate, 20 Kg. N/ha.; *E*, Lime (1 000 Kg.), superphosphate (20 Kg. P_2O_5) and sodium molybdate (0·28 Kg.) per ha.; *G* – *E*, + algæ; *C* – *A*, + algæ; *A*, Control (untreated).

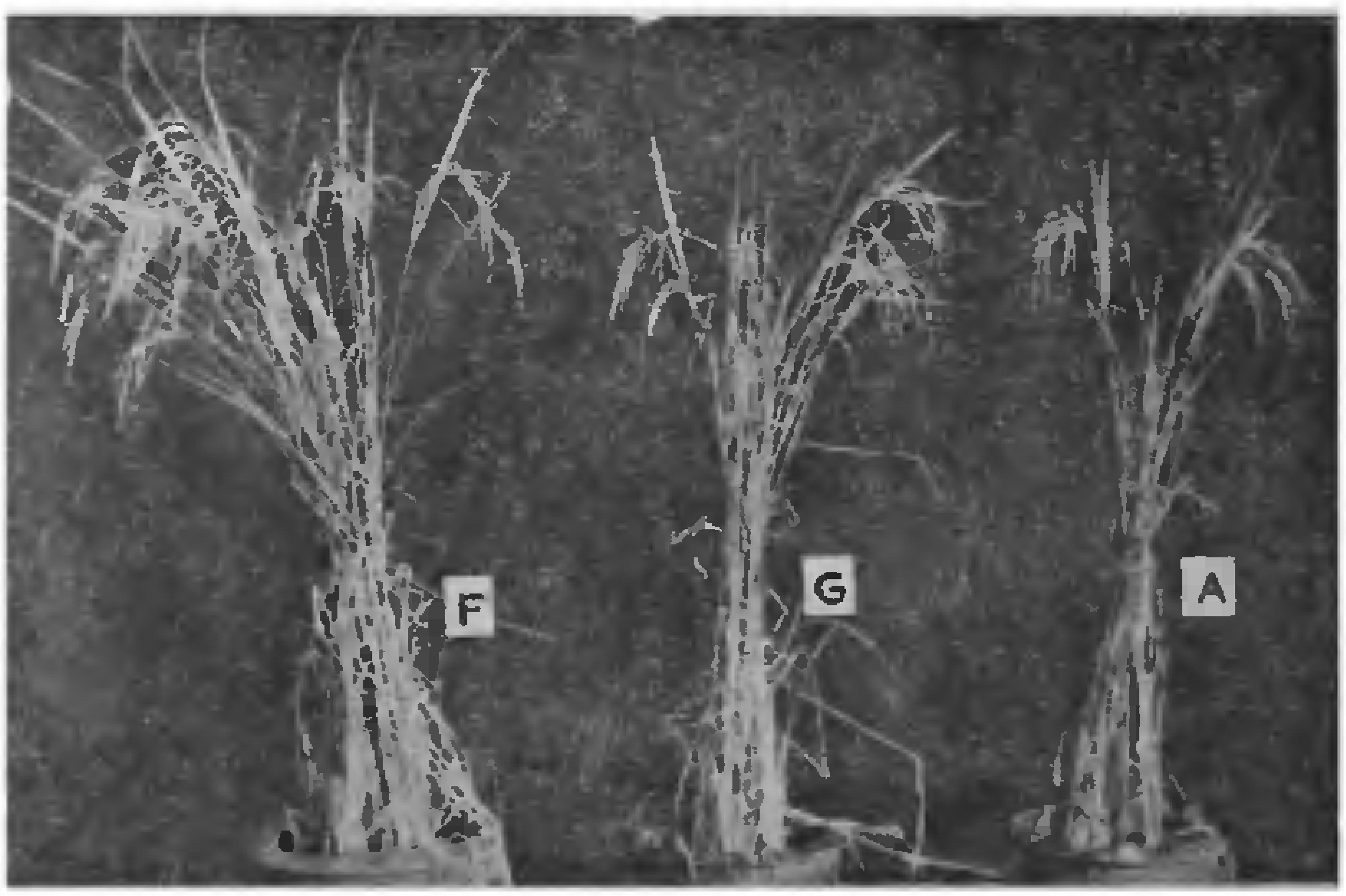

FIG. 2. Photograph of pot culture experiment. Treatments: *F*, Lime (1,000 Kg.), superphosphate (20 Kg. P_2O_5), sodium molybdate (0·28 Kg.) per ha. + partial soil sterilisation; *G*, Lime (1,000 Kg.), superphosphate (20 Kg. P_2O_5) and sodium molybdate (0·28 Kg.) per ha. + algæ; *A*, Control (untreated).

(2) The nutrient mixture itself (Treatment *E*) significantly increased the yields of grain and straw by 23·64% and 25·58% respectively over control treatment under field conditions but not in pots.

(3) The combination of algæ and nutrient mixture (Treatment *G*) produced pronounced increases of 50·24% grain and 74·39% straw to considerably increase the efficacy of blue-green algæ. The beneficial role of these nutrients on the growth and increased activity of nitrogen-fixing blue-green algæ has been reported by earlier workers.[2–10] Lime, by raising the pH of the soil to alkaline reaction also provides a favourable medium for the growth of blue-green algæ.

(4) The effect of partial soil sterilization (Treatment *B*) was found to be considerable. In the pots, increased yields of 181·30% grain and 192·77% straw over the control were recorded. In the field, lower but significant responses of 20·10% grain and 20·15% straw were obtained. Partial soil sterilization in the case of pots also hastened the ripening of crop by 5-6 days.

(5) Partial soil sterilization in combination with nutrient mixture (Treatment *F*) recorded further increases in yields of grain and straw in pots and field.

The beneficial effect of soil heating or partial sterilization may be due to the improvement in the physical properties of soil, killing of undesirable groups of pathogens, parasites and weeds and to increase in the production of ammonia, nitrates and other available mineral plant nutrients.[11-14]

(6) The highest increases of 275·56% grain and 236·28% straw in pots and 53·87% grain and 58·04% straw in the field over control were obtained with combination of partial soil sterilization, nutrient mixture and blue-green algæ (Treatment *H*).

It is evident from these findings that partial soil sterilization, and blue-green algæ in the presence of nutrient mixture contribute to increase in paddy yields.

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A STUDY OF THE POLLEN GRAINS OF *JUSSIEUA* AND *LUDWIGIA* WITH REMARKS ON THE TAXONOMIC STATUS OF *JUSSIEUA SUFFRUTICOSA* LINN.

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THE family Onagraceæ constitutes about 500 species distributed among 40 genera which are temperate and tropical.[1] Embryologically the family is of special interest because of the universal occurrence of monosporic tetranucleate embryo-sac known as the Oenothera type, having been demonstrated in more than 16 genera.[2] A majority of the species studied exhibit a remarkably homogeneous and most fundamental type of embryonomy known among the angiosperms.[3] Warming (1932) describes the pollen grains of the family to be well pronounced, triangular and connected together by viscous threads. Erdtman (1952) gave a detailed palynological account of the family and remarked that the pollen grains of the family are not similar to those of any other family. As far as the writers are aware, *Jussieua repens* Linn., *J. suffruticosa* Linn. and *Ludwigia parviflora* Roxb. have not been studied palynologically. Hence the present study is undertaken.

The material was collected from paddy fields and the nearby areas in the West Godavary District of the Andhra Pradesh. The pollen bearing material was suspended in glacial acetic acid and acetolysed, a part of which is chlorinated. Both acetolysed and chlorinated pollen grains were mounted under the same coverslip in glycerine jelly.[4]

Jussieua repens LINN.

Pollen grains free and not united in tetrads, triporate, angulaperturate, ora lalongate, sexine thicker than nexine with a fine granular structure (Table I, Fig. 1).

Jussieua suffruticosa LINN.

Pollen grains united in tetrads with a mean diameter of 123 μ. Tetrads tetrahedral, with