

ROLE OF ALTERED KARYOTYPE IN VARIETAL DIFFERENTIATION OF *ALLAMANDA CATHARTICA* LINN.

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Allamanda cathartica Linn., a vegetatively propagated climbing shrub of Apocynaceae with large golden yellow flowers, is of horticultural importance. Often it shows striking differences in the size of flower and leaf grown in the same environment. The authors have investigated the cytology of these plants in order to trace if such marked differences in size have any cytological basis.

Cuttings of the two plants were collected and grown in the university garden. Mitotic and meiotic studies were carried out by the aceto-orcein and aceto-carminic schedules on root tips and fresh anthers respectively.

Morphological differences found in the two plants are furnished in Table I.

Cytological studies revealed the following types of chromosomes:—

Type A.—Comparatively long chromosomes with sub-medial primary constriction.

Type B.—Comparatively long chromosomes showing two constrictions, primary and secondary, one sub-terminal and the other submedian in position.

Type C.—Medium-sized chromosomes with primary constrictions ranging from subterminal to submedian position.

Type D.—Short chromosomes with submedian primary constrictions.

Detailed cytological analysis of the two taxa is provided in Table II.

The chromosome numbers of *A. cathartica* L. ($2n = 18$ and $n = 9$) confirm the earlier^{2,4-7} findings. The presence of identical chromosome numbers in both varieties does not agree with the earlier⁸ findings on *Plumeria* (another member of Apocynaceae) where polyploidy was observed in the large-flowered variety. Secondary association of bivalents in meiosis may indicate six as the base number in both taxa.

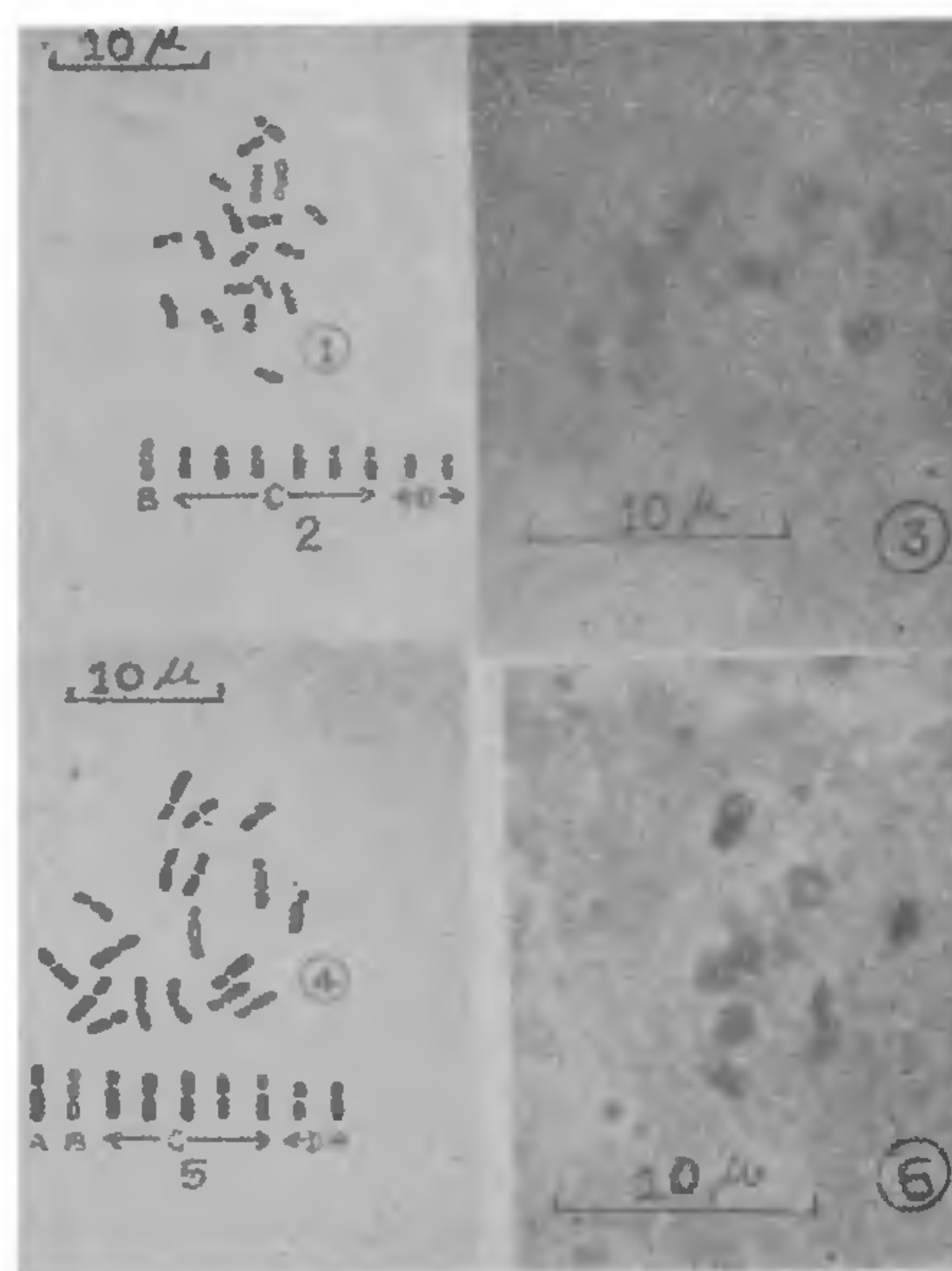
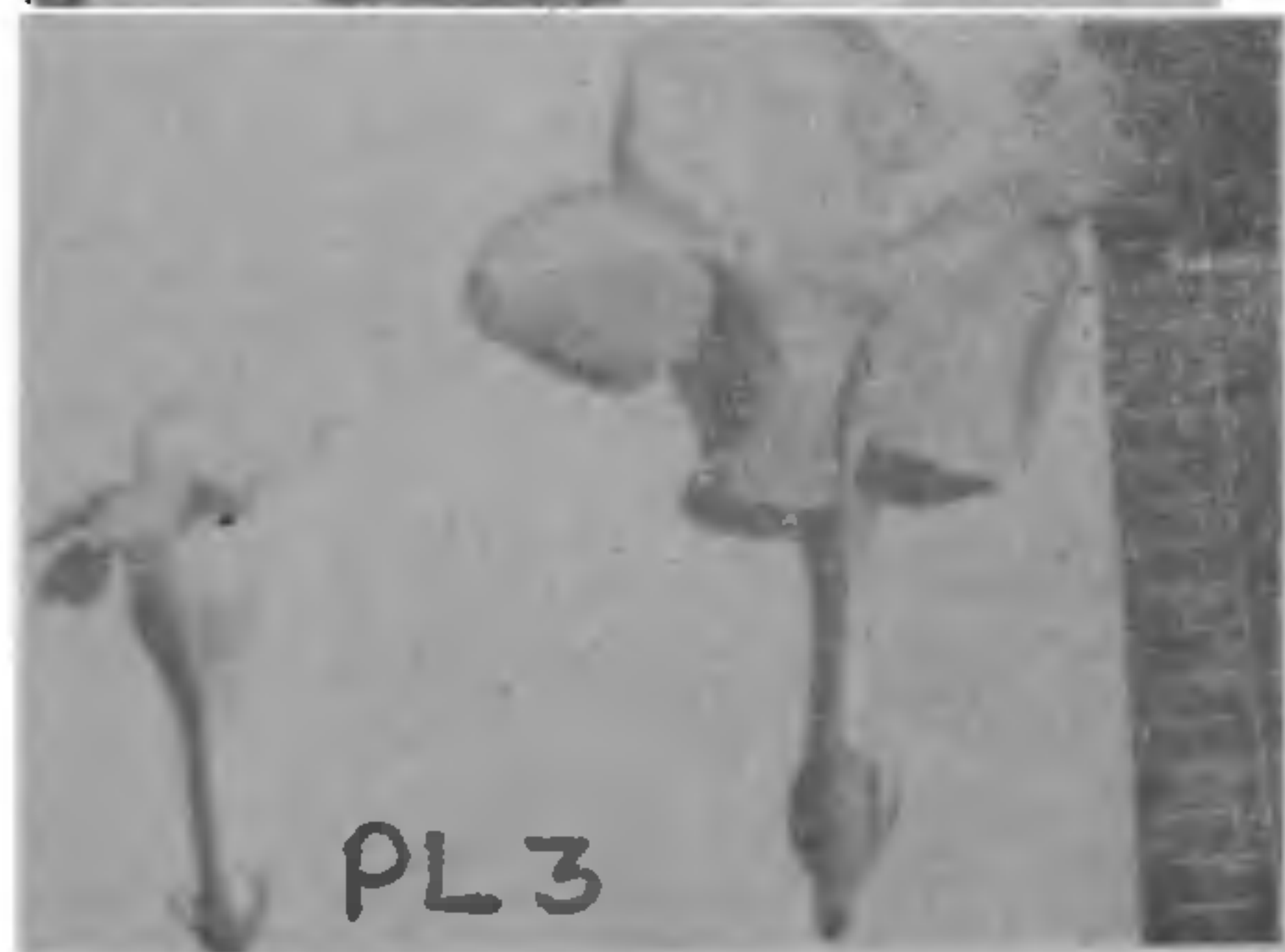
The two taxa show similarity in their chromosome numbers. However differences in chromosome structure are evident. The chromosomes of C type in the *small* variety possess mostly subterminal primary constrictions while in the *large* variety most of them show submedian primary constrictions. Type A, which is present only in the *large* variety, distinguishes the two taxa cytologically.

TABLE I

Name of the taxon	Leaf length (cm)	Flower size (cm)	Pollen diameter (μ)	Pollen fertility (%)
Plate No. 3				
<i>A. cathartica</i> Plate 1 (small)	9.1	7.4	17.5-23.13	38.29
<i>A. cathartica</i> Plate 2 (large)	12.6	11.2	5-25	62.21

TABLE II

Name of taxon	Chromosome No. $2n$	Chromosome No. n	Chromosome structure	Size	Special features if any
<i>A. cathartica</i> (small)	18 (Fig. 1)	9 (Fig. 3)	$B_2 + C_{12} + D_4$ (Fig. 2)	$1.15 \mu - 1.92 \mu$	Secondary association of bivalents $1 \times 3_{II} +$ $1 \times 2_{II} +$ $4 \times 1_{II}$
<i>A. cathartica</i> (large)	18 (Fig. 4)	9 (Fig. 6)	$A_2 + B_2 + C_{10} + D_4$ (Fig. 5)	$1.92 \mu - 2.69 \mu$	Secondary association of bivalents as above



FIGS. 1-7. Figs. 1-3. *A. cathartica* (small variety), showing somatic metaphase chromosomes $2n = 18$ and its idiogram (Figs. 1 and 2); meiotic metaphase I $n = 9$, showing secondary association. Figs. 4-6. *A. cathartica* (large variety), showing somatic metaphase $2n = 18$ chromosomes and its idiogram (Figs. 4 and 5); meiotic metaphase I $n = 9$. Fig. 7. Histogram showing total chromatin content in haploid complement of the two taxa of *A. cathartica*.

Pollen fertility is much higher in the *large* variety. Still seeds do not set usually. This suggests that some incompatibility factor may be involved in influencing fertilisation. Pollen fertility of *small* variety is nearly half of that of the *large* one. Regular bivalent formation could not be correlated with pollen sterility especially in the *small* variety.

The differential amount of chromatin content (Histogram; Fig. 7) may suggest that the two plant taxa differ in their heterochromatin content, as the morphological characteristics of both taxa are highly similar excepting the size of leaves and flowers, which are quantitative in nature¹.

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PLATES 1-3. Photographs of *Allamanda cathartica* (small and large varieties) showing differences in size of leaves and flowers.

The presence of identical chromosome numbers in the two taxa indicates that structural alterations may play an important role in the origin of new varieties.

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ENERGETICS AND ECONOMICS OF BLUE-GREEN ALGAL CONTRIBUTION TO RICE CROP SYSTEM

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RICE is apparently the only major crop to whose nitrogen economy, non-symbiotic nitrogen-fixing blue-green algae make a significant contribution and crop yields provide an indirect measure of their agronomic role⁴⁻⁷. In a cropping system it is necessary to determine the efficiency of the inputs in generating the output products. The present communication is an attempt to evaluate the blue-green algal contribution in a rice crop system by using the economics and energetics approaches³.

Monetary quantification was done in terms of grain output *vis-a-vis* the cost of the network of all inputs. Since all the input energy sources, except the algal and added fertilizer nitrogen, are the same both for the algalized and non-algalized series, calorific quantification was done in terms of added nitrogen and grain yield. The data used for computations were drawn from 463 field trials conducted in eight States. For calculations, the calorific value for the rice grains was taken as 4.4 Mcal/TDN (total digestible nutrients)² and the energy equivalent for nitrogen as 12.34 Mcal/kg¹.

Table I summarizes the algal contribution in terms of monetary quantification in twenty farmers' holdings indicating an average net profit of Rs. 518/ha and the economic efficiency works out to 1:25.9 in terms of the cost of algal input. The economics approach is, however, subject to fluctuations in the market systems.

Table II shows the energy output in terms of grain yield in the absence of added nitrogen input. On an average, algal input generated about 7,453 Mcal/ha,

TABLE I

Monetary quantification of algal contribution to the grain yield of rice (values mean of 20 farmers; P:K 50:50) (cost of BGA Rs. 20/ha)

Nitrogen (Kg/ha)	Grain yield (Kg/ha)	% increase	Net profit* (Rs./ha)	Economic efficiency
100	4,222			
100+BGA	4,766	12.8	518.25	25.9

* Net profit calculated after deducting the cost of all the network of inputs like land preparation, labour, irrigation, fertilizers, seeds, pesticides, BGA, etc.

TABLE II

Estimated energy output due to algal application (10 Kg/ha) (values mean of 160 trials; P:K 40:15)

Nitrogen (Kg/ha)	Grain yield (kg/ha)	Mcal for rice grain/ha	Additional energy output (Mcal/ha)	% increase
0	2,079	6,098.4		
0+BGA	2,541	7,453.6	1,355.2	22.2

which was 22.2% more than that obtained in the absence of algae. This capacity of algal resource to generate additional energy was clearly reflected even in presence of high levels of energy input in the form of chemical nitrogen. A 14% increase in the energy output was observed when an input of 1,234 Mcal was supplemented with algae (Table IV). Precise quantification of algal activity in terms of nitrogen is not possible, although their contribution is in the range of 20-30 kg N/ha as obtained by acetylene-reduction assays.

Table III summarizes the extent of energy compensation through algal input at different levels of chemical nitrogen input, indicating that on an average about 320 Mcal energy in the form of fertilizer nitrogen could be saved without significantly affecting the energy output in terms of grain yield. Although these analyses are based on a 'single-resource-use', these may be used in three ways in a rice cropping system. Firstly, in the absence of any added energy input in the form of chemical nitrogen algal input could generate about 1,350 Mcal of net yield for rice grains alone. This is particularly important for areas lacking in economic viability for investment in costly energy inputs. Secondly, to obtain, for example, an output of 14,921 Mcal/ha, an input of