

cals on this peculiar disease. By taking 40 lb. of *Khari Nimak* per acre as standard, the rates of the various chemicals were fixed as shown below:

TABLE I

Treatments	Rate of application
A. <i>Khari Nimak</i>	40 lb. per acre
B. Sodium sulphate	40 lb. per acre (13 Na:9 sulphur)
C. Aluminium sulphate	40 lb. per acre (9 sulphur)
D. Ammonium sulphate	37 lb. per acre (9 sulphur : 8 nitrogen)
E. Ammonium chloride	30 lb. per acre (8 nitrogen)
F. Sodium chloride	33 lb per acre (13 Na)
G. Control (No treatment)	

These chemicals were applied to the diseased crop in equal areas 5' x 7'. The treatments were randomised and replicated twice. Within four weeks of the application of these chemicals, the beds which received treatments A,B,C and D became green and had put up new growth. A couple of weeks later these beds showed no sign of the disease. Treatments E and F, however, showed some gradual improvement, which never reached a stage of complete recovery.

At maturity all the beds were separately harvested. The results obtained are stated below:

Treatment	Average yield per acre in lb.	% increase on control
A. <i>Khari Nimak</i> ..	1726	194.5
B. Sodium sulphate ..	1678	189.1
C. Aluminium sulphate	1505	169.6
D. Ammonium sulphate	1701	191.7
E. Ammonium chloride	1041	117.3
F. Sodium chloride ..	1002	112.9
G. Control ..	887	100.0

From the above statement it may be seen that *Khari Nimak*, ammonium sulphate, sodium sulphate, aluminium sulphate have given fairly good results—giving an increased yield of 94.5, 91.7, 89.1 and 69.6% respectively. Out of these treatments *Khari Nimak* has given the best result. Ammonium sulphate, however, has given the next best performance in yield. Ammonium chloride and sodium chloride have also given an increase of 17.3 and 12.9% in the grain yield respectively. When the results of the treatments A,B,C and D are examined in comparison with that of E and F it appears

that perhaps sulphates in the treatments A, B, C and D have something to do with the increased yield obtained with these treatments. It is with these treatments, as already stated, the plants had completely shaken off the symptoms of the disease. The soil analysis of the diseased plots has given an indication of sulphate deficiency. Diseased plant materials were examined for fungi, insects and eelworms, but nothing discriminating was found that could be held responsible for the symptoms.

Incidentally it may be mentioned that the diseased plants when uprooted and replanted in a disease-free plot quickly improved and shook off all signs of the disease, whereas those which were replanted in a diseased plot rapidly deteriorated.

Experiments to introduce this disease artificially by creating sulphate deficiency in the culture medium is in progress.

Bihar Agri. College,  
Sabour (Bhagalpur),  
July 29, 1949.

A. B. SARAN.

1. Butler, E. J., "The cultivation of rice in Spain and the recent international Rice Congress at Valencia", *Agri. Jour. of India*, 1914, 9.
2. Hector, G. P., "Ufra disease of rice" *Dep. of Agri. Bengal Bull.*, No. 2.
3. Woodhouse, E. J., "Crop pest hand-book for Bihar and Orissa, 1913.

#### SEED SETTING IN KUDZU VINE, *PUERARIA THUNBERGIANA*

KUDZU VINE (*Pueraria thungergiana*) is assuming an increasing importance in the soil conservation programme as an effective soil binder; it also affords high bulk of very nutritious forage for the livestock. Its propagation on extensive scale has been handicapped due to its absence or poor seed setting ability.

Systematic work, carried out at Poona, to induce flowering in this species has proved inconclusive.<sup>1</sup> The only other record where the kudzu vine has flowered was at Pusa where the flowering was recorded by Joshi even in the first year.<sup>2</sup>

This vana has been under observation in the Agrostology Section of the Division of Agronomy, Indian Agricultural Research Institute, New Delhi. A single plant received from Mr. N. V. Joshi, Poona, was planted in Mid. Block A3 on 18-10-'45. The growth was affected by frost during December, but

fresh growth was observed in the last week of January. The vine was manured with 4 oz. of ammonium phosphate on 16-1-'46; no manuring was done subsequently. Since then the vine has spread profusely; it suffers heavily due to frost in winter and puts on vigorous growth in spring.

For the first time flowering was observed on 8-9-'48, i.e., about three years after planting. Flowering was moderate and was observed on north-east to south-east aspect only. Shedding of flower was a rule, original purple colour turning into bluish after shedding. Natural pod formation was detected on 20-9-'48 on a shoot that happened to climb on a wire fence post. This pod was unfortunately found missing.

In order to understand the general failure of the effective pollination, the carpel was examined and it was found that the stigmatic surface was hard. Flowers on four separate inflorescences were pollinated artificially on 23-9-'48. One pod was observed on each of the two inflorescences so treated. The mature pods were small and contained only one seed each.

The vine remained dormant during winter months and started spring growth in February, 1949. Flowering was observed on 20-4-'49 and natural pod formation occurred by 1st week of July. There was considerable shedding of flowers as last year but the number of pods formed this year is about 8-10.

The formation of flowers and pods after the third year is in conformity with the recorded observations in U.S.A.<sup>3</sup>, where the seed formation in kudzu was found to be best in vines of over three years of age, climbing on small to medium-sized trees, in permanent pastures with deep soils.

My thanks are due to Dr. J. N. Mukherjee and Dr. T. J. Mirchandani for kind encouragement.

P. M. DABADGHAO.

Indian Agri. Research Institute,  
New Delhi,  
August 12, 1949.

1. N. V. Joshi, "Annual Report, 1945-46 on I. C. A. R., Scheme for the Cultivation and Distribution and for Investigation of Condition of Flowering and Setting Seed of Kudzu Vine" (unpublished). 2. —, "Kudzu vine (*Pueraria thunbergiana*), *Agric. and Live stock in Ind.*, 1933, 3, 586-92. 3. Paul Tabor, "Seed Produc-

tion by Kudzu (*P. thunbergiana*) in the South Eastern United States during, 1941," *Jour. of the American Society of Agro.*, 1942, 34-4, 389.

#### AN OIL-BEARING ALGA FROM THE PALANA LIGNITE (? EOCENE) OF RAJPUTANA

THE theory of the algal origin of bog-heads was first advanced by Bertrand and Renault<sup>1</sup> in 1892: the 'yellow bodies' of the Permian kerosene shales of New South Wales were described by them as remains of a microscopic alga, *Reinschia australis*; almost similar organisms found in the Carboniferous bog-heads of Scotland were also considered to be algæ, a species of *Pila*. The algal nature of bog-heads was later questioned by Jeffrey<sup>2</sup> who considered that the 'yellow bodies' were spores of higher plants. Later work by Thiessen,<sup>3</sup> Zalessky,<sup>4</sup> Blackburn and Temperley<sup>5</sup> demonstrated that the bog-head fossils are algæ differing but little from the living species *Botryococcus braunii*,<sup>6</sup> a colonial alga found in fresh and brackish waters. *Botryococcus* and its palæozoic allies, contain considerable oil and their sapropelic accumulations have given rise to bog-heads and other forms of bituminous coal. An ill-preserved yellow oil-bearing alga has been recorded by Down and Himus<sup>7</sup> from the Eocene Kohat oil-shales; and more recently Lahiri<sup>8</sup> has described supposed algal structures from the kerosene shales of the Saline series whose age is still a matter of controversy.



*Botryococcus* (?) sp. ×460. From lignite (? Eocene)  
Palana, Rajputana.

This note records the presence of oil-bearing yellow bodies similar to *Botryococcus braunii*, in a lignite from Palana,