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TABLE XII Response of coconuts to manuring

Treatments	Average yield of nuts per tree per annum (4-year period)			
	Manure applied in trenches	% increase	applied broadcast	% increase
1. Ammonium sulphate (3 lb.) *plus* ashes (20 lb.)	58·1	37·7	75·0	77·7
2. Cattle manure (100 lb.)	60·1	42 2	55·4	31 3
3. Ashes (20 lb)	55·0	30·3	44·0	4 3
4. Raw fish (40 lb.) *plus* ashes (20 lb.)	51 5	22·0	—	—
5. No manure	42.2	—	—	—

(To be continued)

A Review of Some Experiments on the Eradication of Nut Grass (*Cyperus rotundus* L)

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The nut grass (*Cyperus rotundus* L.) is a formidable weed in the tropics and sub-tropics. Results of experiments on its control have been reported by Ranade and Burns, 1925 (India), Smith and Fick, 1937 (America), and Andrews, 1940 (Egypt). The morphology of the plant as described by these workers is in general as follows:- The weed possesses an elaborate underground system consisting of tubers, rhizomes and roots. Rhizomes connect the tubers with each other and from the latter are developed extensive roots. The tubers are white and succulent when young but turn reddish brown and finally black with age. They consist of congested nodes and internodes with buds and scale-leaves at the nodes. The rhizomes proceeding upwards from some of the tubers produce the aerial parts of the plant consisting of rosettes of linear leaves and with the umbel-bearing scapes arising from the centre of the rosettes. At the junction of the leaves with the upward-growing rhizome is an enlargement resembling a tuber which has been termed a "basal bulb" by Ranade and Burns (l. c). Like the tuber, the basal bulb contains storage material and is capable of producing rhizomes from buds at its nodes.

Propagation Tubers and basal bulbs are the principal means of reproduction in this plant. Ranade and Burns (l.c.) found that only 1·5 per cent of the seed produced was viable. Andrews (l.c.) tried germinating the rhizomes but without success. When an underground tuber germinates it gives rise to a rhizome which may either grow upwards and produce an aerial shoot or may end in another tuber. Smith and Fick (l. c.) observed that a new tuber is formed in about three weeks after an isolated tuber is planted. The first rhizome to develop from an isolated tuber grows upward and produces an aerial shoot; rhizomes formed later from either the tubers or basal bulbs may terminate in new tubers. In a green house experiment Smith and Fick (l. c) found that 146 tubers and basal bulbs were produced from a single tuber in three and a half months.

Apical dominance Smith and Fick (l. c) have shown that an apical dominance exists in the tuber as well as in each nut grass system taken as a whole. When a tuber is planted, its terminal bud if present is the first to sprout, and the other buds develop acropetally. A number of experiments carried out by these workers have shown that in any one nut grass system only a certain number of terminal tubers produce aerial shoots, the other tubers remaining dormant. Thus a count of the aerial shoots will not give a true indication of the degree of infestation in an area. The tubers that are dormant are able to produce shoots only when freed from the dominant effect of the terminal tubers This phenomenon of "apical dominance" therefore explains why cultivation frequenty *appears* to increase the infestation of nut grass in an area.

Control Measures 1. *Cultural* Ranade and Burns (l. c.) have stated that frequent cutting of the aerial parts would finally cause exhaustion and death of the tubers. Andrews (l. c.) compared nut grass systems whose aerial shoots were constantly cut with those whose shoots were allowed to grow and found that although aerial growth is necessary for the production of new tubers, frequent removal of the tops would be a long and laborious method of eradication.

Smith and Fick (l. c.) as well as Andrews (l. c.) have shown that contrary to popular belief the nut grass tuber is highly susceptible to drought and heat. Smith and Fick (l. c) found that tubers were killed by four days' exposure in the shade, the critical moisture content being 15 per cent. Tubers exposed to direct sunlight however lost their viability at a higher moisture level (about 24 per cent). In an experiment carried out during July—August (maximum temperature 35° C.) with many cloudy days and high humidity, Andrews (l. c.) obtained germination percentages of 100, 93, 47, 16, 7 and 0 with tubers exposed for 0, 1, 3, 5, 7 and 14 days respectively. It was shown by Andrews (l. c.) that free tubers whether exposed on the soil surface or in a soil of low moisture content can remain alive only if they are able to obtain continuously moisture from the sub-soil. Smith and Fick (l. c) subjected tubers to varying temperatures and found that tubers were killed by an exposure of one hour at a temperature of 60° C. At 50°C it took 96 hours to kill the tubers. They concluded that although summer temperatures may have some direct detrimental effect upon the tubers, it is probable that the indirect effect of increased evaporation and consequent desiccation of the tubers is of greater importance in the destruction of tuber viability.

These observations suggest that eradication of nut grass can be accomplished if the roots of the tubers could be cut during the summer season and the tubers then left in the dry soil. Trials made by Andrews (l. c.)

in the heavy clayey cotton soil of the Gezira (Egypt) have shown that by cultivating to a depth below the level of the lower tubers (12 inches) and allowing the tubers to remain in the dry soil for one month, a nearly complete eradication of the weed could be effected in a single season. In the sandy loam soil of Norfolk (U S A.), Smith and Mayton found that the weed could be eradicated by ploughing or disking at intervals of three weeks or less throughout two successive seasons. Such treatment reduced the infestation by approximately 80 per cent in the first year. This was later tested on ten different types of soil ranging from sandy loam to plastic clay (Smith and Mayton, 1942) The results showed that a near eradication could be effected in all the soil types tested by ploughing at intervals of three weeks during two successive seasons. The authors point out that the efficiency of tillage as a means of destroying nut grass is based on the fact that in all these soils the majority of the tubers are located in the upper six inches of the soil. The only instance where satisfactory control was not obtained was one where the experiment was located on a low, poorly drained clayey soil, indicating that tillage methods may not be useful for nut grass control on areas that are likely to remain wet for lond periods.

2. *Chemical* Fumigation with chloropicrin has been shown to be very effective against nut grass by Godfrey (1939). This is however suitable only for small patches, being too expensive for application on a field scale. White (1934) recommends the application of cheap-grade salt either dry or in the form of brine to small areas at the rate of one pound per square foot. This is fit only for land not required for cultivation such as garden paths, tennis lawns etc. Fromm (1942) found that nut grass was almost completely destroyed by the application of solutions of sodium chlorate and calcium thiocyanate after the soil was turned over to a depth of 5 to 6 inches, only one per cent of the weed remaining alive after ninety days. This treatment is said to have no deleterious effects on succeeding crops.

3. *Biological* Summerwille (1933) has reported two insect enemies on nut grass in Australia. *Antonina australis* (a scale insect) and 2, a mealy bug; but these were not found to be useful in preventing the spread of the weed. Andrews (l. c.) records three fungus diseases of the aerial portion of the plant, caused by 1. *Alternaria tennissima*, 2. a species of *Physoderma* and 3. a species of *Corticum*. These diseases were more prevalent in the rainy season but no evidence was found that they could kill the plant or exercise any effective control of the spread of this weed.

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Walchandnagar—An Agri-Industrial Enterprise

By K. C. RAMAKRISHNAN

The Founder. Walchandnagar is a veritable wonderland created by Seth Hirachand Walchand from out of what was virtually a wilderness ten years back. A magnificent estate comprising 17,000 acres has been built up round about the old village Kalamb in the Sholapur district of the Bombay Presidency by this inspired millionaire, Walchand, who is better known as a shipping magnate, the builder of the Hindusthan Aircraft Factory, and the manager of the Hume Pipe Co. The latest enterprise of his is in the field of radio engineering. That such a multi-sided industrialist should take to the development of agriculture on the scale noted below would come as an agreeable surprise to most of our readers.

Soil, climate and irrigation. The soil round about Kalamb is shallow and unretentive, though of the black cotton variety. The rainfall is only 21 inches per year and the native population, exhausted by the perpetual struggle for existence, had not the energy and material resources to utilise the irrigation facilities provided from the Nira river by the Government, and went on growing poor crops, raising sugarcane and making *gur* only to the extent of Rs. 20,000 per year, while at present refined sugar is manufactured to the tune of Rs 20 lakhs in the year. Reclamation of land and rendering it fit to receive flow irrigation required Rs. 1 lakh. Drainage had to be constructed for a length of 16 miles—4 miles of it underground—to deal with the excessive moisture and correct alkalinity, a problem in all such irrigated tracts.

On behalf of Marsland Price Co. of which he is the Managing Agent, Mr. Walchand plunged into the business of sugarcane plantation on a large scale and its manufacture into refined sugar on the spot, which is necessary in the case of such a highly bulky and perishable produce as sugarcane. The immediate inspiration was the levy of heavy protective duties by the Indian legislature on sugar imported into India, guaranteed for 15 years from 1932.