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Articles should be as concise as possible and generally with appeal to the lay public. Titles of the articles should be short. Articles on scientific research need not contain the details of experiments conducted, and should avoid, as far as possible, scientific formulae and technical terms. Where technical terms are unavoidable, they should be explained in the text in simple language. Statistical tables should be restricted to the absolute minimum and should be typed on separate sheets with their positions marked in the text. Appropriate mention in the article of the economic value of the results of research and methodological studies will enhance its usefulness. Original articles should conclude with a short summary of the main facts and conclusions.

2. Reference to literature which must be restricted to the very few of importance, should be given in the text wherever possible in chronological order—only the names of authors and years of publication in brackets being given. They should be stated in full after the summary, authors' names following in alphabetical order, as under :—

(i) Name or names of author(s).

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3. Information of a miscellaneous nature and of interest to the general public, facts, observations, etc. relating to TOBACCO are also received for publication.

4. Manuscript should be neatly tvped with double spacing on one side of the paper only and with wide margin. Three copies should be sent. Drawings, diagrams, etc. should be done in Indian ink. Coloured illustrations are not required.

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8. All articles and other materials for publication in "INDIAN TOBACCO" should be addressed to the Secretary, Indian Central Tobacco Committee, 38, Mount Road, Madras-6.

LEAFLETS IN

ENGLISH

Leaflet No. 21 Germination of tobacco seed improves by pre-soaking.

Leaflet No. 22 - New methods bring handsome profits in flue-cured tobacco (under print)

Leaflet No. 23 Unwanted types of flue-cured tobacco - A key to their identification.

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Telugu No. 18 –Germination of tobacco seed improves by pre-soaking.

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INDIAN CENTRAL TOBACCO COMMITTEE

(MINISTRY OF FOOD AND AGRICULTURE GOVERNMENT OF INDIA)

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INDIAN TOBACCO

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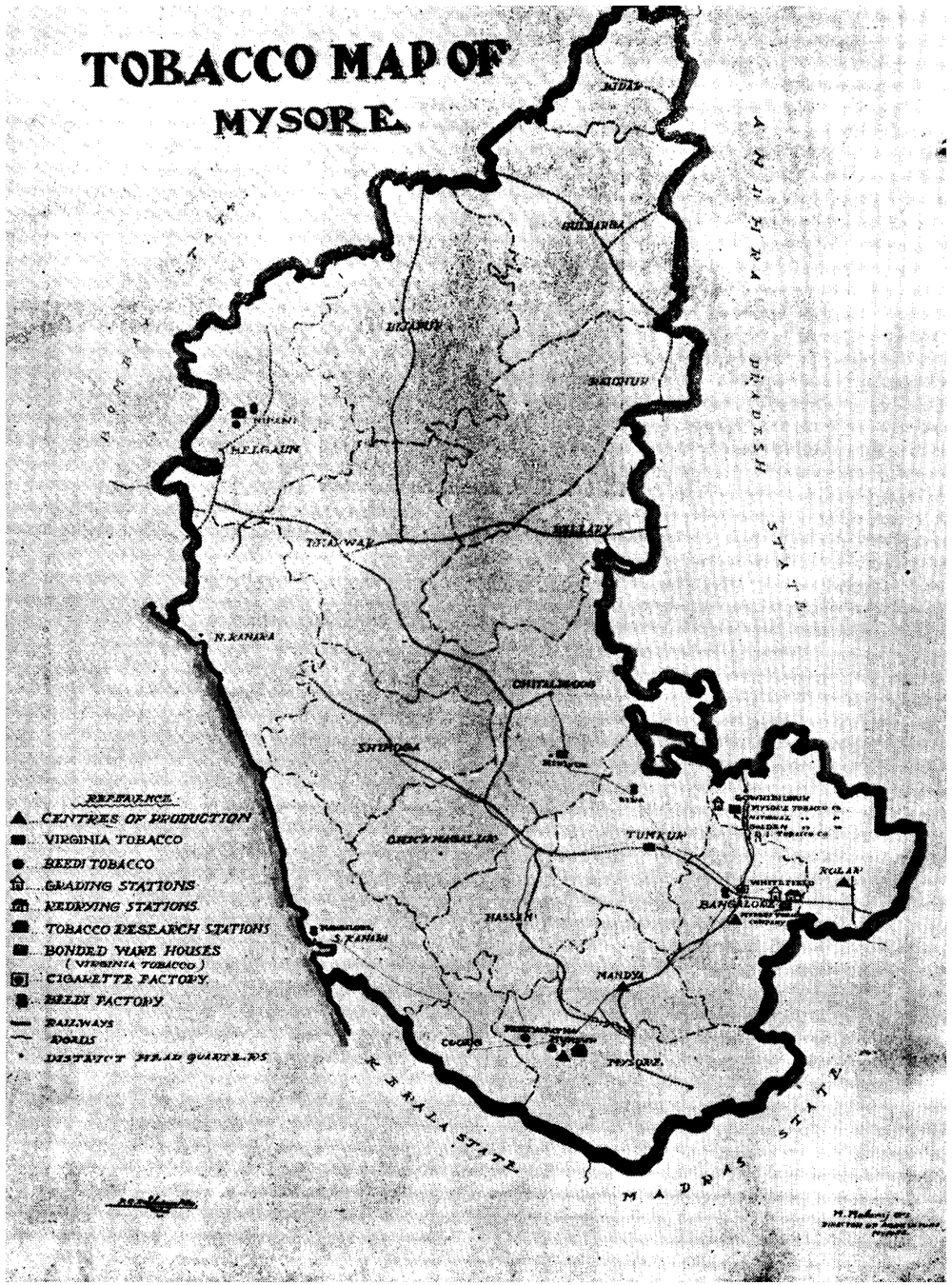
From Left to Right: Mr. ALFRED F. KICKBUSCH, Economic Officer of the Consulate of Federal Republic of Germany at Madras; Dr. M. S. PATEL, Secretary, I. C. T. C.; Mr. GERHARD KUENKEL, German

Dr. N. R. BHAT, Ph. D. (Cantab)

who served the Indian Central Tobacco Committee as Director, Tobacco Research from 14th January, 1955 handed over charge on 14th August, 1958 (A.N.) to assume office as Director, Sugarcane Breeding Institute, Coimbatore. Dr. Bhat, who was on deputation to S. Rhodesia from 13th February, 1956 to 22nd March 1956 to study the methods of production of flue-cured tobacco in that country is the author of a valuable report suggesting various measures on the aspects of promotion through research and extension, of yield and quality of Indian flue-cured Virginia tobacco. He is also the author of several papers dealing with various problems of tobacco research.



TOBACCO IN MYSORE STATE

M. S. PATEL, M.Sc., Ph.D. (U.S.A.)* P. N. B. PILLAI, M.A.**
AND D. THIAGARAJAN, B.Sc.***

After reorganisation the State of Mysore with an area of 72,730 sq. miles occupies the eighth place among the 14 reorganised States of the Indian Union. The agricultural resources of the State have since increased considerably. As regards total area under cultivation she ranks fifth in importance in the country. She holds the first position in respect of Coffee, Cardamom and Ragi, second in Coconut, Castor and Arecanut and third in Tobacco, Cotton and Jowar. The acreage under Cereals, Tobacco, Groundnut, Chillies and Oranges is three times more after the reorganisation of the State.

Tobacco, particularly the bidi tobacco, plays a very prominent role in the economy of Mysore. She ranks third in the Union in so far as area under tobacco is concerned and fourth as regards yield contributing an average of 6.8% of the country's total production of tobacco. During the year 1956–57, about 40,320 thousand lbs. of tobacco were produced from an area of 110 thousand acres.

A table showing the acreage and production of tobacco during the years 1953–54 to 1956–57 in the reorganised Mysore State together with the percentage to the total produced in the country is given below :

Year	Area in thousand acres	Percent to the total area in the Union.	Production in thousand lbs.	Percent to the total production in the Union.
1953–54 ...	115	12.6	49,280	8.2
1954–55 ...	103	12.2	40,320	7.4
1955–56 ...	108	10.7	38,080	5.8
1956–57 ...	110	10.8	40,320	5.9

(*Courtesy :* Directorate of Economics and Statistics, New Delhi).

When compared to other important tobacco growing States, the yield per acre of tobacco grown in Mysore State is not only low but well below the All-India average of 658 lbs. Mostly *Nicotiana Tabacum* is grown in the State of Mysore while *Nicotiana Rustica* is grown in some places to a limited extent. Mysore, Bangalore, Belgaum, Tumkur, Mandya, Chitaldurg, Kolar and Gulberga are the important districts for tobacco. *Nicotiana Rustica* is grown to a limited extent in the districts of Tumkur, Belgaum and Hassan

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** Statistician, and
*** Statistical Assistant, Indian Central Tobacco Committee.

and to a lesser extent in Bangalore, Bijapur and Chitaldurg.

Of *Nicotiana tabacum*, Virginia type is grown in Tumkur, Gulberga, Mandya, Mysore, Kolar and Bangalore districts and the other types mainly in Mysore and Belgaum districts. More than 75% of the total production is confined to Mysore and Belgaum districts, Belgaum alone contributing about 50%.

It is due to the concerted and systematic efforts of the Mysore Tobacco Co. Ltd., which was floated in the year 1937, that Virginia tobacco cultivation developed in the Mysore State. The acreage under this type is not uniformly distributed but concentrated in certain areas in the State.

The Virginia tobacco is grown in Mysore in a season different from that in Guntur (Andhra Pradesh) which is the most predominant tobacco growing zone in the country. In Mysore, early and late plantings are grown under irrigated conditions and in rotation with paddy or sugarcane. Quite a large percentage of the tobacco area in Bangalore and Mysore districts is grown under rainfed conditions in dry lands. It is also observed that paddy growing after tobacco comes up very well. The nurseries are prepared in February and March and seedlings are planted in April, May and June and the leaf is cured usually during July and October. The company phase out their programme of sowing and growing over a longer period.

According to the latest report of the Mysore Tobacco Co. Ltd., it is estimated that about 7,600 acres are grown with Virginia tobacco in the State.

The farmers grow Virginia tobacco under an agreement with the Mysore Tobacco Company at prices fixed at the beginning of the year. There are farmers who enter into contract mainly for the supply of green leaf to the company's centres and there are others owning barns who supply cured leaf to the company at prices fixed at the beginning of the year.

The growers who register with the company receive seedlings and also fertiliser mixtures according to the terms of the contract. Their fields are periodically inspected by the staff of the company and they are advised to carry out different cultivational operations such as earthing, weeding, irrigation and priming at proper times. Great attention is paid to the control of diseases which cause considerable damage to the crop every year. They are also provided with material for plant protection on credit.

The picking of the leaf is arranged only after inspection and issue of picking permits. The mature leaves are picked in the presence of the field staff and carted to the curing centres in the early morning. The leaves are weighed and valued according to the quality of the leaf. The best quality leaf judged by the light yellowish green colour free from disease and matured well is paid the highest price and the dark green leaf is paid the lowest. Immature, diseased and damaged leaves are discarded. Leaf unsuitable for flue-curing is purchased for air-curing.

The quantity and value of green leaf are entered in the pass book issued to each grower. The pass book contains all details of credit transactions with the company and the grower's supplies of green leaf. Payment to ryots is made at suitable intervals. The green leaf is graded carefully and sent to the barns which are usually double furnaced. The best growers are given prizes at the end of the season for supply of quality leaves.

Some of the private curers who supply cured leaf also receive credit facilities from the company. Every facility necessary for flue-curing tobacco is given to the registered grower. The fields of such growers are also periodically inspected and they are advised on the timely operations to be carried out. The private curers are assisted by lending them the services of trained curers for attending to curing and for training the growers' staff in curing and handling tobacco. Many private curers are also assisted to construct leaf-handling sheds and leaf stores through the material aid given by the Mysore Tobacco Company. The cured leaves of the private curers are rough graded first at their own premises and supplied to the company. The company supplies dealwood packing cases for transport. Each case has a net weight of 250 lbs. of tobacco. These cases are weighed at the curer's premises and despatched to the company's Grading Stations at Gowribidnur and Whitefield.

The cured leaves are taken in the company's lorries to the Grading Station, where they are graded in the presence of the curers, and a

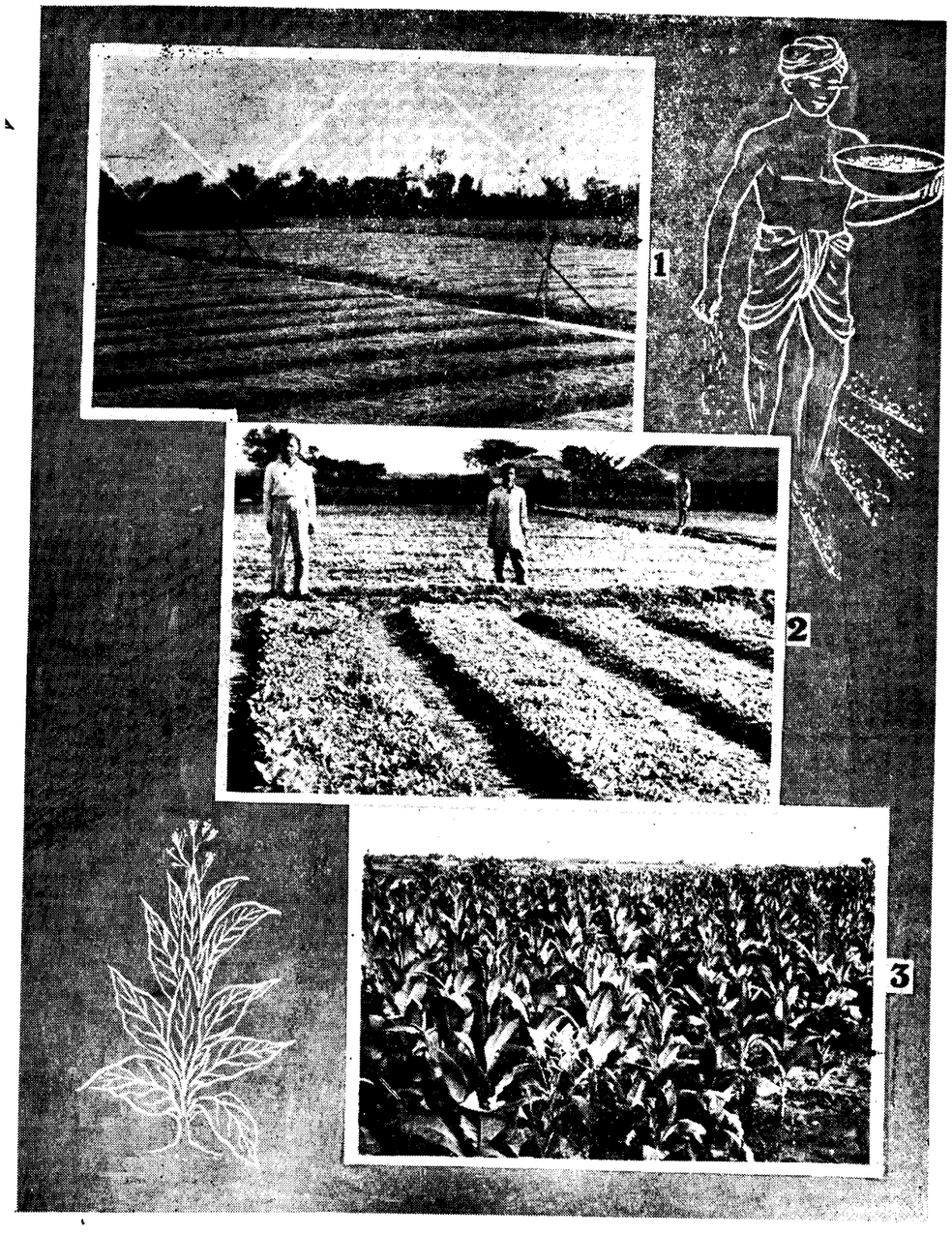
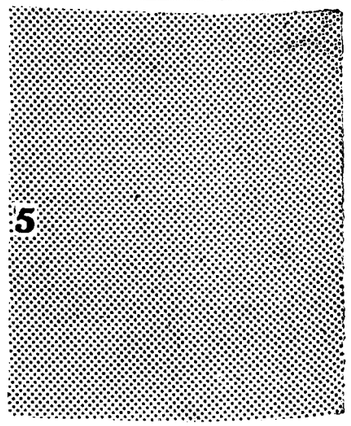


Fig. 1—Tobacco nursery—Sprinkler irrigation. Fig. 2—Virginia tobacco nursery. Fig. 3—Virginia tobacco field.



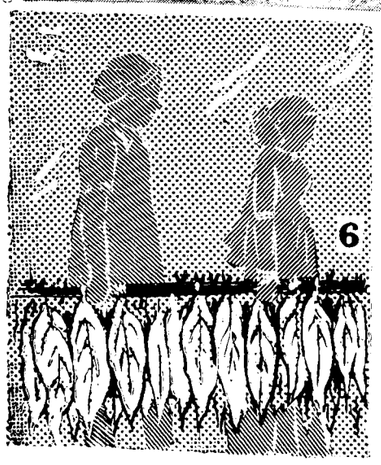


Fig. 4—White Burley.

Fig. 5—Carting of green leaves for curing.

Fig. 6—Curing-barns.

grading report is furnished to the private growers on the result of grading. Payment is made on the basis of the grade outturn at prices already agreed to. The payment on low grades of tobacco is made at the end of the year after the sale of these are concluded. The Mysore Tobacco Company strives to dispose of all grades of tobacco produced by the grower relieving him of the problem of marketing low grade tobacco to others.

The other companies who operate in Mysore State also buy tobacco on the basis of graded quality at the premises of the growers.

The quantity of Virginia tobacco grown in Mysore State is comparatively lesser than that produced from Andhra Pradesh. Due to the strenuous efforts of the Mysore Tobacco Company Ltd., which cover all aspects of tobacco production from the nursery to the curing and marketing of tobacco, the demand for Mysore Virginia tobacco is increasing not only within the country but also on the Continent. This is due to the better quality of the product and systematic methods of sale.

A few acres of Turkish and White Burley tobaccos are also grown in the Mysore State. In the district of Belgaum, mainly the bidi tobacco is grown. The bidi tobacco from this place is as good in quality as that from Gujarat. The principal and popular varieties are Nipani, Mirji, Sangli and Jawari.

Bidi tobacco—S. 20.

The bidi leaf produced in other parts of the State is yellowish brown in colour, medium in texture and strength.

There are only two varieties—broad leaf and narrow leaf, each of which is known by different names in different localities *e.g.*, Anekivi, Chavatikudi, Kongumadari, Krigalmadari, Kathekivi, Balepatte, Jerebandi and Motubandi. These varieties are also used for chewing.

The demand for bidi tobacco is the highest during the months immediately after harvest. It commences to rise in January when the fresh crop starts arriving in the market and is at its peak during February and March. Over 80% of the tobacco produced is sold off during the period extending from February to May. There is improvement in the demand by about the end of October which continues till December.

Bidi tobacco is sold mostly in the form of powder (bhuko or Chura) and to some extent in the form of leaf bundles used for chewing, bidi and chilum smoking. For preparing bidi tobacco powder, the entire plant is harvested by cutting it above 2″ to 3″ from the ground and in the Hunsur area about 6″ above the ground. The plants thus cut are kept in the field and exposed to the sun. They are removed to the thrashing yard for making powder after 4 to 6 days.

The manufacture of bidi is an industry widely spread over the country. There is practically no area in India where bidis are not manufactured to a greater or lesser extent. Mysore is one of the important states where bidis are manufactured. The other important States are Madhya Pradesh, Madras, Bombay, Andhra Pradesh and Delhi.

Tobacco manufacturing industries

There is one up-to-date redrying plant in the Mysore State owned by the Mysore Tobacco Co. Ltd., with a normal rated capacity of 1,200 lbs. per hour of straight laid leaf and strips and 2,500 lbs. of tied leaf (hands) per hour. Out of the 15 cigarette factories in India, there is one fairly big factory in the city of Bangalore. The chewing tobacco industry is also located in the State, though on a smaller scale.

Within the State, different types of tobacco are cleared for home consumption for different purposes. The following table gives the comparative figures of the quantity of unmanufactured tobacco cleared for home consumption in the Mysore State as well as for the Indian Union and percentage to the total during 1953–54 to 1956–57.

Year	Indian Union (in million lbs.)	Mysore	Percentage to the total
1953–54 ...	529.3	18.6	3.5
1954–55 ...	564.8	19.1	3.4
1955–56 ...	620.1	21.9	3.5
1956–57 ...	583.8	36.4	6.2

(*Courtesy :* Central Board of Revenue, New Delhi).

Total quantity of different types of tobacco cleared for various uses in the State during 1956–57 is given below :

1956–57

No.	Types	Quantity (in million lbs.)
1.	Flue-cured Virginia ...	10.0
2.	Other than Flue-cured Virginia but used for cigarettes and smoking mixtures ...	2.8
3.	Bidis	7.9
4.	Snuff	0.3
5.	Hookah	1.0
6.	Chewing	5.7
7.	Agricultural purposes ...	4.0
8.	Destruction	1.4
9.	Stalks and stems	3.3
	Total ...	36.4

(*Courtesy :* Central Board of Revenue, New Delhi).

Of the total tobacco cleared after paying excise duty in the State in 1956–57, about 27.5% was for cigarettes, 21.7% for bidis, 15.7% for chewing and 11.0% for agricultural purposes.

The important manufactured tobacco products in India are cigarettes, cigars, cheroots, bidis, snuff, chewing and hookah tobaccos. Bidis, snuff, chewing and hookah tobacco and to some extent cigars are manufactured as a cottage industry. Bidi and chewing industries are common in Mysore State.

Raw tobaccos from other States are brought to the State for consumption purposes. The inter-state transport is usually carried out through rail and by road. The transport of tobacco by two wheeled bullock carts is an important means usually employed for carrying tobacco. Lorries are also used whenever there is difficulty in transporting through rail.

Tables showing the extent of inter-state trade of tobacco during 1953–54 to 1956–57 are given below.

Exports (by rail etc.) of tobacco from Mysore State to different trade belts of India.

Year	Quantity in million lbs.
1953–54	6.3
1954–55	4.8
1955–56	5.8
1956–57	5.3

Imports of tobacco into Mysore State by rail etc., from different trade belts of India :

Year	Quantity in million lbs.
1953–54	12.1
1954–55	10.1
1955–56	10.4
1956–57	7.8

(*Courtesy :* Department of Commercial Intelligence and Statistics, Calcutta).

Only about 15% of the total production of tobacco in India is exported and the rest is consumed within the country. Out of the 15%

Note : The figure given against the year 1956-57 is for the re-organised Mysore State.

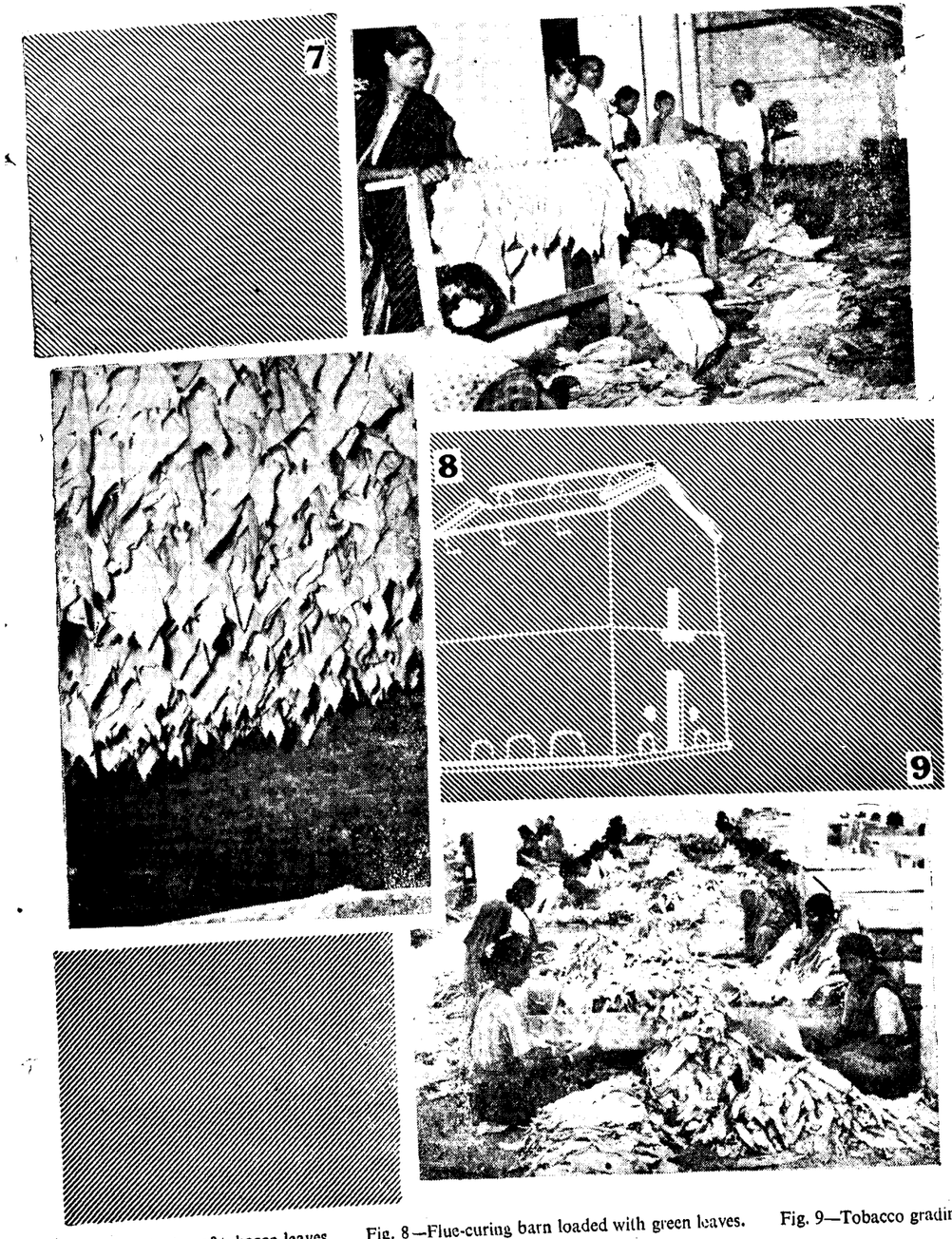


Fig. 7—Stringing of tobacco leaves. Fig. 8—Flue-curing barn loaded with green leaves. Fig. 9—Tobacco grading.

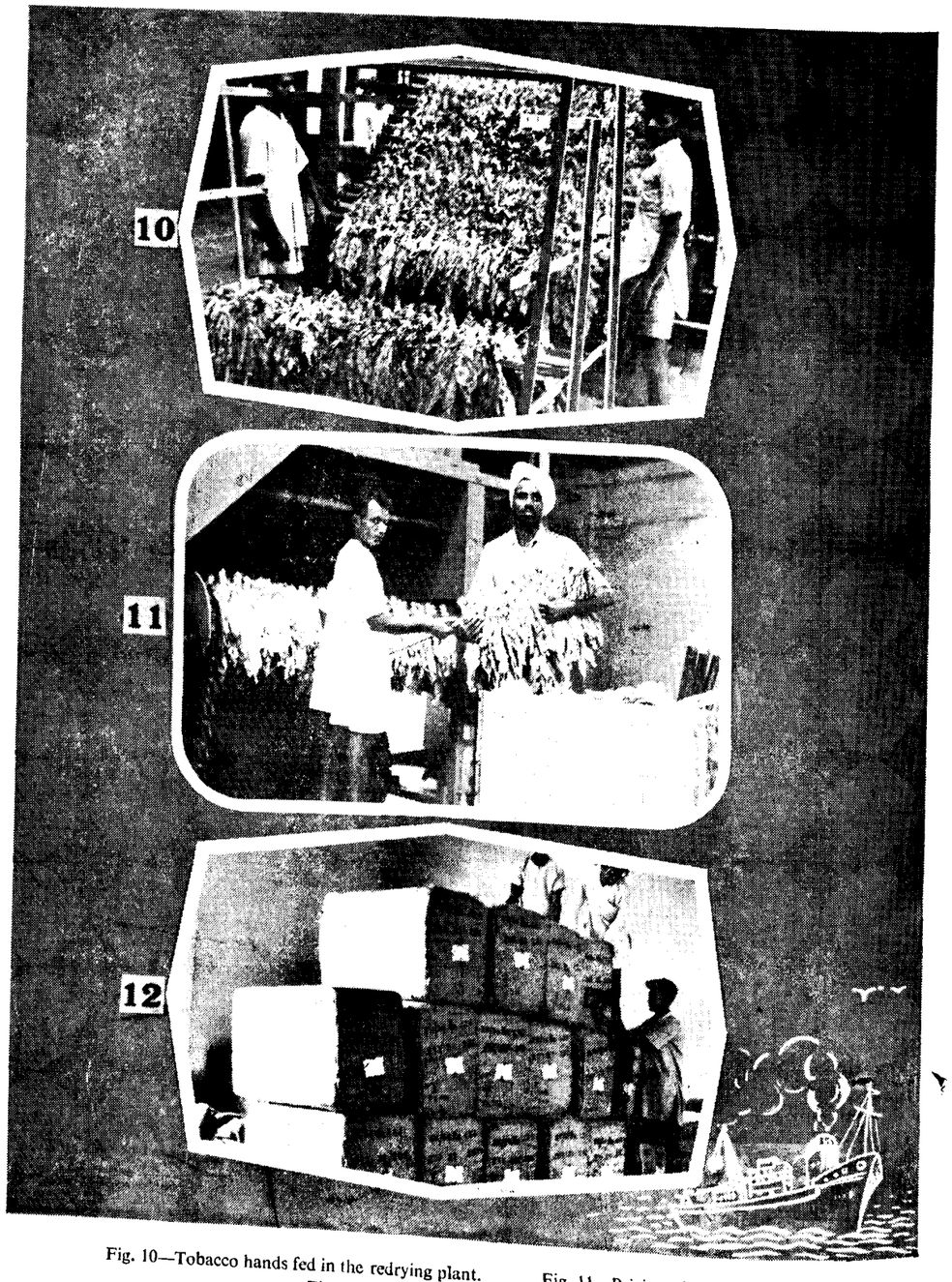


Fig. 10—Tobacco hands fed in the redrying plant. Fig. 11—Prizing of tobacco in cases.
Fig. 12—Tobacco bales ready for export.

a major portion is of unmanufactured Virginia tobacco produced mainly in Andhra Pradesh. The tobacco produced in Mysore State is mainly consumed within the country. Although India is manufacturing crores of bidis, most of them are consumed within the country and only a small quantity is exported. Bidi tobacco and bidis are generally exported to Aden and Dependencies, Egypt, Kuwait, Bahrein Island, Saudi Arabia, Yeman, Singapore, Ceylon, Mascut, Oman, Zanzibar, Pemba etc.

In the year 1956–57 only about 3 million lbs. of bidis worth about 1.2 crores of rupees were exported. Ceylon imported a major portion of Indian bidis. Quantitative restrictions existed for bidi, bidi leaf and bidi tobacco for which destination quotas were fixed every half year by the Government of India. Since March, 1955, these restrictions have been withdrawn and exports of handmade bidi, bidi leaf and bidi tobacco are licensed freely.

The Indian Central Tobacco Committee, a corporate body set up by the Government of India, is making endeavours to improve the quality of tobacco grown in India. There are at present two research stations in Mysore State (1) Bidi Tobacco Research Sub-station, Nipani (Belgaum district) and (2) Tobacco Research Station, Hunsur (Mysore district).

The Bidi Tobacco Research Sub-station, Nipani was established in 1948. The main function of the Station is to carry out improvements in the varietal and cultural aspects of bidi tobacco. Under the Second Five-Year Plan, two schemes, namely, Training in the improved methods of tobacco cultivation handling and curing and Production and Distribution of pure seeds have also been sanctioned. These will be initiated shortly.

Tobacco Research Station at Hunsur established in early 1957, is mainly functioning to improve both the quality and yield per acre of cigarette tobacco produced in Mysore State.

Besides, a scheme for control of powdery mildew, partly financed by the Committee, is also being carried out by the Government of Mysore.

For the benefit of tobacco growers in Mysore State, leaflets in Kannada language on " Manuring, Transplanting and Care of Virginia Tobacco," " Control of Orobanche" and "Curing of Virginia Tobacco " were printed and distributed freely by the Indian Central Tobacco Committee. Two more leaflets, (1) " Important pests of tobacco and their control with a field key for their identification " and (2) " New methods bring handsome profits in flue-cured Virginia tobacco " are under preparation and these will be published and distributed to tobacco growers in that State shortly.

From the above it is seen that Mysore State is one of the largest tobacco growing States in India next in importance to Andhra Pradesh and Bombay. *Mysore is a potential producer of quality tobacco suitable not only for internal consumption but also for export to foreign countries.*

The Mysore Tobacco Co. Ltd., which is a unique organisation in the country in so far as the development of flue-cured Virginia tobacco is concerned, is taking concerted efforts to develop and improve the yield of tobacco in the State. Both the modern redrying plant which redries tobacco and the newly built grading hall at Whitefield are well maintained by the Mysore Tobacco Company. Besides, a big cigarette factory which manufactures quality cigarettes is an asset to the famous industrial city of Bangalore.

(Our thanks are due to Sri B. P. Balakrishna, General Manager, The Mysore Tobacco Co. Ltd., for furnishing authentic and valuable information regarding the Mysore Tobacco Company, Ltd.)

*BETTER METHODS OF CURING TOBACCO

S. MEHTA

Vice-President, Indian Central Tobacco Committee

" Flue-cured tobacco can bring big money .....It's an expensive crop to grow.....But after hard labour in producing the crop, farmers lose big sums because of faulty curing methods....."

In India, flue-cured tobacco growers lose a lot by adopting poor methods of curing. What is important is more uniform conditions in tobacco barns, temperature and humidity control devices for safer and better curing in less time and less cost than most of the barns on tobacco farms.

How can farmers put better curing practices into operation ? Here are the most necessary requirements for effective and efficient curing :

1. The heating unit must be of such design and construction that it will burn fuel efficiently.

2. Heat distribution must be uniform throughout the barn of tobacco to ensure even cure in all parts. Draft controls are important to equalise heat distribution.

3. Barn must be made independent of weather-winds, rains, etc. It is important to insulate the barns. Air intakes around the base of barns are very helpful. Any good barn can be put in proper condition at comparatively little cost.

4. Ventilating system must be under complete control. Ridge ventilators are important in temperature and humidity control for best quality tobacco and in conserving heat.

After the barn is properly equipped and the tobacco housed, it is very important that the curing process be operated correctly. At least one-third of the water in the tobacco should be removed during the yellowing period. If too much water is left after yellowing it may result in a condition called ' sweating.' In such condition the ridge ventilators should be left open until the humidity begins to decrease. Then they should be closed. Here is where many farmers make a big mistake. They usually do just the opposite ; they close the ventilators in the early stages of curing and then open them when they should be closed for the later stages.

This mistake tends to prevent water evaporation at the time when getting rid of water is more important and then in later stages a lot of heat is lost unnecessarily. The time required for the yellowing period varies with the type of tobacco, but it usually takes about 24 to 30 hours.

An important phase in temperature during the stem ' killing ' stage is to hold down to not over 175 degrees whereas many farmers very often go as high as 200 degrees. Besides, drying out the tobacco too rapidly and thereby damaging quality, the 200 degree temperature is a waste of heat.

To sum up the advantages of tobacco curing by the method suggested above, a farmer is likely to save on fuel cost, time of curing and substantial increase in quality and value of tobacco.

* Based on the writer's own experiments and experience as well as on details and figures given to him by experts on Tobacco Curing in U.S.A.

FIRST SOUTHERN REGIONAL CONFERENCE IN SOIL TESTING HELD AT BANGALORE IN MAY 1958

Talk on Manurial Problems in Tobacco and the Role of Soil Tests

N. R. BHAT, Ph.D. (Cantab)

Director, Tobacco Research, Central Tobacco Research Institute, Rajahmundry

MR. PRESIDENT AND FELLOW DELEGATES,

I do not suppose that I can have any *locus standi* in this conference of soil chemists and experts gathered here to discuss soil testing problems. If I have agreed to offer my views on the subject, it is only to respect the wishes of the sponsors of this conference who have very kindly desired me to do so. You will know what to expect of me if you were told that I am neither a soil specialist nor a chemist and my experience of tobacco manuring is of only 3 seasons.

Manuring is a practice which has come into vogue through age long experience that a crop usually needs more nutrients than the soil on which it grows can provide. The practice has been put on a rational basis since Liebig proved through his famous experiments that N, P and K are the major nutrients required by plant life. The urge for higher production from smaller areas consequent on population growth and commercialisation of agriculture has led to unconscious as well as conscious selection of varieties and strains which respond more and more to better cultivation and manuring. For these reasons, the crop varieties that we grow today are such as have potentialities of high response to manuring and fertilisation. This may be said to be true of all cultivated crops.

The soil may be likened to a culinary store furnished with some quantities of provisions. The housewife who plans the menu for a dinner has to estimate her requirements of the various provisions, ascertain what provisions and in what quantities are available in the store and how much she has to supplement. This she has to do on the basis of usable rather than raw provisions. For example, if she wants wheat flour for her preparations she will have to take into account as to how much wheat flour there is in stock and not how much of wheat. Very similarly, the former who wishes to raise a good crop must know how much of plant food ingredients are required by the crop he wishes to raise, how much there is in an available form already in his soil and how much he has to add through manures and fertilisers. This would mean that in any planned crop production, two things are very essential, first, the estimates of nutrient requirements of the crop proposed to be raised and, second, soil testing for nutrients and related ingredients. The per acre requirements of nutrients of most of the important economic crops for their average growth have already

been estimated from the knowledge of chemical composition of the crops. Naturally, therefore, soil testing is our important desideratum today.

Speaking of tobacco, the crop is rather unique in its problems. Unlike in most other economic crops, the harvest tobacco consists of leaves. As leaves are borne at different positions on the plant and therefore differ considerably in their chemical composition even on the self-same plant, the produce is likely to be non-uniform at least to some extent. For example, the leaves higher up on the plant are richer in proteins and nicotine and poorer in carbohydrates and sugars as compared to those in lower positions. Being a 'luxury' crop, quality rather than yield is more important in this case. This is particularly so in the case of flue-cured Virginia tobacco and in cigar wrapper in which quality is the crux of the produce. For this reason, certain standards of quality and commercial uniformity, according to the usage in which the tobacco is to be consumed, have to be observed by the producer. If he does not, he may as well not grow the crop, as it will surely not be economic to do so.

The tobacco grown in India is used in various ways, *e.g.*, smoking as cigarettes, pipe mixtures, cigars, cheroots, 'bidis,' 'chuttas' and hookah (hubble-bubble) and in chewing and snuff. The tobaccos used for these purposes may roughly be grouped as (1) mild, *e.g.*, cigarette and cigar wrapper which are rich in carbohydrates and sugars but contain little nitrogen and nicotine (2) strong, *e.g.*, 'bidi,' 'hookah,' 'cheroot,' 'chutta' and 'chewing' types which are rich in nitrogen and nicotine but poor in carbohydrates and sugars; and (3) medium mild, *e.g.*, cigar types which are more mild than strong. Except in the case of snuff and to a small extent in hookah, which can utilise the produce from any varieties of the required strength, the groups of varieties raised are specific to the usages, depending largely on the chemical composition of the leaf in respect of nitrogen, nicotine, carbohydrates and sugars which, in addition to the methods of curing and fermentation, determines the strength and flavour of the produce. In addition to the right choice of varieties, appropriate cultural methods have to be adopted to obtain the produce of the required chemical composition.

As in all other crops, it is customary even in the case of tobacco to apply a basal dose of farmyard manure or compost well in advance of planting and thereafter apply fertiliser either just before planting or during the stand of the crop in one or more instalments. In this respect, the flue-cured Virginia tobacco may be said to stand apart from all others. For, while tobaccos in general require heavy doses of nitrogen applied in such a way as to feed the crop continuously till the maturity of the leaf, this tobacco can stand only small doses of the quickly acting kind which would nourish the crop before the maturity of the leaf, if the harvest is to be curable and suitable to produce a high proportion of bright grades which are valued in cigarette manufacture. For this reason, except for a small basal dose of farmyard manure, application of organic manures and fertilisers is to be avoided in its case. The reverse is the case with other tobaccos, though quick acting inorganic fertilisers may have to be applied occasionally to boost the growth when the crop is backward. It is common in tobaccos of the latter kind to apply upto about 50 to 100 cartloads of farmyard manure (in the case of 'Jati' tobacco of West Bengal it is even upto about 100 to 150 cartloads). In most of the tracts, farmyard manure is the main if not the only source of nutrition to tobacco. It simultaneously improves both yield and quality of the leaf so much so that lack of crop rotation is found to result in improvement of its quality. Merchants are known to pay higher prices for the produce from fields known to grow tobacco continuously for a large number of years. Whenever possible, farmyard manure is substituted by sheep penning. Green manuring with leguminous crop, though practised by a few farmers, does not seem to be desirable. My personal impression is that it results in the production of succulent, immature leaf deficient in quality.

If the farmer can afford to use fertilisers, he prefers oil cakes which can be applied with advantage to a pretty large extent. Experiments in recent years at the Tobacco Research Stations, Pusa (Bihar), Dinhata (West Bengal), Ferozepore (East Punjab) and Vedasandur (Madras) have shown that economic increases in crop production coupled with improvement in leaf quality take place with increasing doses of fertilisers supplying upto about 100 lbs. nitrogen per acre. At the Institute of Agriculture, Anand (Bombay), the optimum dose of nitrogen has been found

to be as high as 160 lbs. to 200 lbs. per acre. No response has been observed either to phosphorus or potash, at any of the places. It is well known that the P_2O_5 requirement of tobacco is small (*i.e.*, about 15 to 20 lbs. per acre). It is possible that most of the crop's requirements may be met from the large quantities of cattle manure usually applied and from the soil, though it is not improbable that the lack of response may also be due either to the high pH and or high calcium content of the soil.

Unfortunately, data available from experiments with organic manures are very scanty in the case of flue-cured Virginia tobacco in India to make it possible to say as to how far they are beneficial to the crop. But the general impression prevailing in all tobacco growing countries is that organic matter is good to tobacco from the point of both yield and quality. In support of this view, I may quote the following abstract of a paper entitled "Relation of soil organic matter to the production of flue-cured tobacco" by H. A. Horton (1942) : —

> "Results obtained from field plot experiments with flue-cured tobacco have shown that there is a general tendency toward higher yields of marketable leaf from plots containing larger amounts of soil organic matter. Where tobacco was grown every year the highest yields and the highest total organic matter were obtained where manure was applied and rye cover crops were grown in the intervals between seasons. The 2 year rotations in which tobacco was alternated with rye gave greater returns per acre than where tobacco was grown every year. The 3 year rotation in which tobacco followed two crops of rye provided much larger yields and returns per acre, and the soil organic matter was considerably higher than where tobacco was grown every year. In the 2 year rotations the application of manure caused significant increase in the content of soil organic matter but it did result in considerably increased yields of tobacco. At the same time the level of the organic matter was maintained under the increased production. While the soil organic matter may not have been significantly increased by applying manure or by returning the rye crops produced in a 2 year rotation, the production of leaf was enhanced by these practices. In this way the value of the crop was definitely related to the amount of organic material which was added to the soil."

One feature common to all tobaccos including flue-cured Virginia in India is that all of them except the hookah tobacco in North India and flue-cured Virginia in Mysore are grown almost wholly under rainfed conditions. The annual rainfall in these areas varies from about 30 to 50 inches. Therefore, the crop usually suffers from inadequacy of moisture, more particularly in the surface layers of the soil, in the latter part of the cropping season when the development and filling of the leaf take place. This was attributed as the reason for no response at Guntur and inconsiderable response at Rajahmundry of the flue-cured Virginia crop even to nitrogenous fertiliser and it was suggested that measures, *e.g.*, deep ploughing and mulching aimed at soil moisture conservation should go a long way in promoting better crop growth (Bhat, 1957-*a*). Further, due to moisture deficiency, the crop when grown in the field develops almost always a deep root system and, except in early stages of growth, draws its nourishment from the lower layers of the soil where there is more moisture. Therefore, it is to be expected that a major portion of the fertiliser has to be applied by deep placement if it is to be utilised by the crop. These inferences have been amply borne out from the highly beneficial results obtained from deep ploughing in summer, deep placement of fertiliser and mulching tried on flue-cured tobacco at the farm of the Central Tobacco Research Institute, Rajahmundry (Bhat, 1957-*b*). The results have been further confirmed in the 1957–58 season. In general, the benefits of these treatments individually have been 17.5 per cent, 14 per cent and 11.1 per cent respectively and their combined effect 23.4 per cent (219 lbs. cured leaf per acre). A happy feature of these improvements is that quality of the leaf has also improved in size, body and colour. There are also indications that with deep placement there is some response to P_2O_5 as well. Deep placement of fertiliser by 'plough drilling' for

Bidi tobacco at Anand (Bombay) and by means of 'Sohaga' (*i.e.*, Coulter) following a plough for hookah tobacco at Ferozepore (East Punjab) has also proved to be beneficial, though to a lesser extent as the depth of placement in these cases was only 3″ to 4″. All the above measures may prove equally useful even in the case of all other rainfed tobaccos.

From the facts presented above it will become clear that there is a great scope to increase the per acre yields in consonance with quality in the case of tobacco by suitable modifications in the methods of cultivation and fertilisation. It will be very desirable to intensify production in a crop like this, from the point of economic returns to the grower as well as from the more important point of relieving a part of the area under it for food crop production.

Two important aspects of tobacco manuring deserve to be taken note of from the point of soil testing. One, it is essential to estimate the amount of organic matter present in the soil, since many soils are likely to be very deficient in it due to its being burnt away by the heat of the tropical sun and liberal application of farm yard manure is becoming more and more difficult on account of the heavy demand on it for food crops and other cash crops. Second, though the responses of the crop to fertilisers, especially to P_2O_5 and K_2O, are extremely poor under the popular methods of cultivation, they are likely to increase with heavier crops produced under improved methods of culture such as those tried recently and found beneficial in the case of flue-cured Virginia tobacco. It is probable that still better methods may become available in future, opening up greater scope for utilisation of manures and fertilisers.

I understand that soil testing work has been undertaken on a countrywide basis in the U.S.A. since the beginning of this decade and is proving very useful in advising the farmers in the application of manures and fertilisers. I do not as yet know the full details of the working of soil testing units, but gather that they roughly determine by rapid tests the contents of the soil in respect of organic matter, calcium and available nitrogen, P_2O_5 and K_2O. The need for the last three ingredients requires no explanation as they are well known to be the major nutrients of plants. Calcium is being estimated as it affects the soil pH and as its proportion in the soil is known to affect the availability of P_2O_5 and K_2O. Soil phosphorus is more readily available in neutral or slightly acid soils. In alkaline soils with the presence of excess calcium carbonate, phosphorus combines with calcium forming tricalcium phosphate which is of low solubility. Within certain limits, an inverse relationship is known to exist between the intake of calcium and potassium.

The role of organic matter in the soil is multifarious. Firstly, it is known to modify the physical properties of the soil as affecting cohesion, porosity, reaction and ion exchange capacity. Secondly, it is the store-house of chemical elements essential for plant growth, *viz.*, nitrogen, phosphorus, calcium, iron, manganese and others. Thirdly, the decomposition of organic matter produces organic nitrogen which is gradually converted into nitrates and serves as plant food, and also various organic and inorganic acids which act on soil minerals and release plant nutrients. Fourthly, organic matter serves as the source of food and energy for the soil micro-organisms which are engaged in the manufacture of plant nutrients.

The soil testing programme is expected simultaneously to give us a general overall picture of soil fertility ingredients in the tobacco growing tracts as well as characterise the fertility of soils in farmers' fields as a basis of prediction of the need for soil fertilisation and amendments. I feel very happy to announce that a Soil Testing Unit is being located at the Central Tobacco Research Institute, Rajahmundry, for this purpose under the auspices of the Indo-American Technical Co-operation Programme. Though it will be too much to think that soil testing is going to be "a single value soil management cure-all" for us, we may reasonably hope that it will render considerable assistance in systematically tackling our manurial problems in tobacco.

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HOOKAH AND CHEWING TOBACCOS OF NORTH BENGAL

II. MARKETING†

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During the course of the survey conducted for ascertaining cultural and curing practices prevalent in some of the tobacco growing areas of North Bengal, attempts were also made to collect as much information as possible on the prevalent marketing practices and other related matters. This information was further augmented by discussing the subject-matter with tobacco merchants and central excise officials and by observing various processes at warehouses and actual sale transactions in important *hat* centres. The information thus collected has been summarised in this article.

Supply areas

The principal tobacco producing areas within the central excise division of Cooch Behar are Dinhata, Cooch Behar and Mathabhanga circles. The statistics of circlewise distribution of acreage, production etc., within this division are given in Table 1.

Table 1

Circlewise particulars of area, production etc., in Cooch Behar Division (average of five years 1953–54 to 1957–58)*

Circle	Number of growing villages	Area acreage	Number of curers	Average area per curer acre	Production lbs.‡	Yield per acre lbs.	Potential C. Excise Revenue@
Cooch Behar ...	469	9,148	16,284	0.56	5,480,355	599	2,740,178
Dinhata ...	266	10,070	14,793	0.68	5,862,609	582	2,931,304
Mathabhanga ...	124	8,275	11,549	0.72	5,287,180	639	2,643,590
Changrabandha	251	5,410	13,896	0.39	4,503,250	832	2,251,625
Alipurduar ...	222	1,930	4,078	0.47	1,067,384	553	533,692
Division total ...	1,332	34,835	60,601	0.57	2,200,778	637	11,100,389

From the table above, it would be seen that Dinhata Circle occupies a leading position in respect of area and production. Cooch Behar and Mathabhanga circles are next in order.

† PART II—'Growing and Curing' appeared in the last issue.

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* Courtesy—Asst. Collector, C.E., Cooch Behar

‡ Average of four years 1953–54 to 1956–57

@ At the current rate of 0.50 nP. per pound

Preparing the produce for the market

Some growers sell their tobacco leaf as such in Jhur form without spreading and sorting while others go in for spreading. Spreading of leaves is usually done when the leaves are in *condition*. The leaves are judged to be in condition when they are sufficiently moist and pliable to permit stretching and spreading without breakage. The family team usually takes up this operation with a family chat. Every day a small quantity of leaf is spread and the entire lot thus finished in about 2 weeks' time. In this process the individual leaves including their margins are fully stretched, arranged one over the other and pressed. When the leaf bunches on an individual jhurs have thus been spread the cluster of petioles is secured and a bamboo "Tamaal" tied around it. The hand thus tied is locally known as '*Peti*.' Care is always taken to put good leaves on both faces of a hand to give it a good finish. Immediately after a peti is prepared it is pressed putting some weight over it so as to prevent the spread leaves from wrinkling back. The operator usually sits on a freshly prepared peti and continues his work with another jhur. During the process of spreading, leaves that are too much *fired* (jala pata) are sorted out by some farmers and tied into separate hands. At the end of a sitting, whatever hands have been made are put into a circular bulk heap (*gadi*) with their butt ends pointing outward. One such bulk accommodates several days' spreading. The bulks develop heat due to fermentation and are broken and remade at 2–3 weeks interval before their interior gets overheated. This process of breaking and remaking the bulks is repeated at intervals till the produce is finally sold out. The prevailing rates of spreading are Rs. 2 per maund of tobacco leaf.

In jati growing villages of Adabari, a few fanciful growers clean the individual leaves with a soft hair brush to remove dust etc. This treatment is restricted to the best quality leaves only and is done with a view to win fame by securing the highest price in the locality.

Methods of marketing

The growers sell their produce through one or more of the following methods, *viz*., (i) sale at the homesteads, (ii) sale at the local hats, (iii) sale through co-operative societies. Most of the tobacco is sold at the homesteads. Small quantities are commonly sold at local hats mainly to meet the immediate needs. Sale through co-operative societies covers only an insignificant proportion of the total quantity produced in the area.

(i) *Sale at the homesteads :* In the rural areas a class of intermediaries known as *Paikars* play an important role in assembling the tobacco. These paikars engage themselves in money-lending and in the trade of different commodities such as jute, tobacco etc., during the season. Some of the paikars are well-off farmers and carry on business on a limited scale as a side activity. They purchase the tobacco from growers mainly for resale at the right time and operate in localised areas in which they are known to growers. The paikars move from grower to grower, examine their produce and negotiate purchases. If the rates offered by the paikar are acceptable to the grower then transaction is finalised and sale effected. The tobacco is weighed and ex-homestead delivery is given. The paikar removes the tobacco to his godown in bullock carts. He occasionally advances money to the growers against their anticipated tobacco. After the sale is effected, the loaned amount is deducted by the paikar and the balance is paid to the grower as and when required by the latter or according to the terms mutually agreed upon. The paikars occasionally do some sorting and retying of hands to give the produce a presentable form for resale in the market. This operation may be done before removing the produce from growers' premises or at the paikars' place. The paikars have no direct contact with the wholesalers of the terminal markets at the consumers' end and hence sell the tobacco to the tobacco merchants located at the important centres in the producing areas. Thus approximately 1000 paikars in Cooch Behar district play a very important role in assembling the tobacco.

(ii) *Sale at the hats :* Sale (of perishable and non-perishable farm products) at the hats is the important channel for disposal of farm products in this area. The rural people usually purchase their provisions from such local hats in quantities enough to carry them through till the next hat day. These hats are usually held twice a week at important places scattered throughout the tract. In such hats farm products are sold by the producers direct to consumers, paikars and wholesalers. The important hat centres for tobacco in Cooch

Fig. 1. A view of the HAT showing a grower with his tobacco awaiting sale.
„ 2. A pile of purchased tobacco in HAT.
„ 3. A cart-load of Paikar's tobacco at the HAT being examined by the merchant.
„ 4. Attenders sorting and grading tobacco in the merchant's warehouse.
„ 5. Tobacco bales ready for despatch.
„ 6. Tobacco hands (peti) tied in various shapes (a) Chha-

Behar district are Pundibari near Cooch Behar town, Dinhata and Gosanimari. In Dinhata and Pundibari hats motihari tobacco forms the main bulk while in Gosanimari hat jati tobacco is predominant. Tobacco sold in hats by individual growers is usually in small quantities not exceeding one maund. It is usually brought to the hat in " Bhar " (hung on the two end of a bamboo pole) borne by the man on his shoulders. With the money realised from the sale of these small quantities of tobacco, the grower buys his daily provisions from the hat on the same day. No special transport cost is, therefore, incurred by the grower as he normally visits the hat otherwise also for purchasing his daily provisions.

Such farmers who bring tobacco for sale in the hat sit in rows in the open space allotted for the purpose and pile their produce before them. The wholesalers and paikars are the two agencies engaged in purchasing at such hats. They move around the piles of tobacco, examine the produce and offer rates (fig. 1).

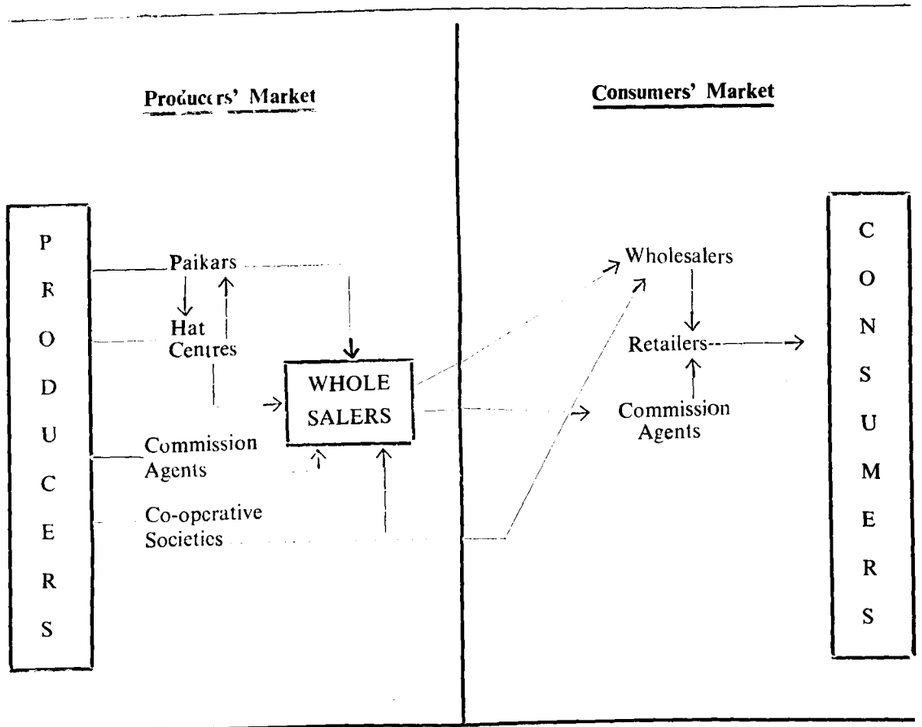
The tobacco marketing season commences by the middle of March or beginning of April and continues upto June. During March–April the weather being hot the head loads brought by the growers are usually sprinkled lightly with water to prevent breakage of leaf. On examining the produce the hands appear slightly moist and the buyer takes this fact into consideration while settling the price. The price usually is settled after considerable haggling. The buyer collects the tobacco purchased in piecemeal at one location in the hat where his representatives weigh the tobacco with a country pan balance and make cash payment after deducting the conventional charges (fig. 2). The purchased tobacco is heaped at that location on tarpaulins and to keep the leaf in condition occasional sprinkling of water on the heap is done. At the close of the hat, the tobacco purchased by the merchants is carted to their warehouses.

The paikars also bring cartloads of tobacco for sale in such hats. The carts are parked in the open space in the same section but away from the site where headloads of tobacco are piled. The wholesale merchants owning warehouses purchase this tobacco. Several merchants participate in such sale transactions. These merchants move around the various carts, inspect the tobacco leaf (fig. 3) and offer their rates under the cover of a cloth. The transaction is effected if the rates are acceptable. The tobacco is weighed and carted to the warehouse of the merchant. The total value of the produce is paid in cash in one or more instalments. Usually transactions effected upto the month of June following the tobacco harvest season are fully paid in cash while for transactions settled after June payment may be made in instalments. Under Central Excise rules growers ordinarily can retain tobacco without bonding upto the end of June following the tobacco harvest and hence paikars insist on cash payment so as to enable them in turn to pay cash to growers.

(iii) *Sale through co-operative societies :* The total quantity of tobacco handled by the societies is very small. It is estimated that less than 1% of the total tobacco produced in the tract passes through the co-operative societies. The Okrabari and Pakhihaga (located at Gosanimari) are important societies handling tobacco. The Member growers deposit their tobacco wholly or in part with the societies at the rates fixed by the purchasing committees of such societies. The tobacco collected at the society is stored in its warehouses, sorted, processed and sold to the wholesale merchants either at the terminal markets or in the producing areas itself. The profits earned by the societies are distributed amongst the members as per rules. New societies are being organized and one Central Society at Dinhata located.

Location of wholesale trade

Due to lack of adequate communication facilities in the interior villages wholesale trade is located only at few important towns connected by rail or good roads. The important centres in the Cooch Behar district are Dinhata, Cooch Behar, Mathabhanga and Changrabandha. The onward transmission to terminal markets is done from these centres. The wholesale merchants at such centres own large and spacious godowns where storing, sorting, processing, packing and despatching is directly supervised by them. Most of the tobacco produced in the tract ultimately is assembled at these centres. The wholesalers mostly move to different road side hats located away from their centres and purchase the tobacco. Important assembling agencies are Paikars, commission agents and wholesale merchants. The principal marketing channels through which the tobacco leaf flows from producers to consumers are outlined in the following diagram.



Marketing channels for Hookah and Chewing Tobaccos of North Bengal.

Marketing charges

The maund weight of the local tobacco trade is equivalent to 46⅔ standard srs. since the local seer wt. is taken equivalent to 93 tolas as against the standard seer of 80 tolas. As a matter of convention transactions in tobacco in the local market are made on the basis of the local maund and converted to standard maunds for excise or other official purposes. The person who weighs the produce at the time of its purchases may retain 5–6 srs. of tobacco as *Baisari* or *gadi* for his seat. At the time of payment the buyer cuts the price per maund by a fraction of a rupee (2 annas to 4 annas per Md.). This is termed as '*Magun*.' The merchants also make a lump sum deduction from the total value of the purchased tobacco to offset the anticipated driage losses later on roughly on the basis of one seer to 2½ srs. per maund. A part of the outstanding balance payable to the sellers may also be waived by the merchant on flimsy grounds of depression in the market, charity etc. Prior to the levy of central excise duty on tobacco these recoveries were made by the merchants in kind but since then the practice has shifted to cash adjustments and is gradually on the decline.

The charges on Baisari, Magun, Charity etc., borne by the grower usually vary with individual growers depending upon his power of resistance, the relationship between the buyer and the seller and terms agreed upon at the time of sale. It is however roughly estimated that such charges amount to a minimum of about Rs. 2 per maund.

If the produce is sold in the hat, the seller also pays the regular 'Hatai' charges at the rate of 1 anna for 5 srs. 4 annas for a headload exceeding 5 srs., and 12 annas per cartload as the case may be. This charge is collected by 'Izzatdar'. The Izzatdari rights are sold by auction.

Storage and bulking

The tobacco purchased directly from the homesteads and hats by the paikars is only temporarily stored by them in their godowns. Under central excise rules, the paikars can retain tobacco in their stock upto the 30th June of the year following the year of harvest. The godowns are usually G.I. sheet structures with mostly Kuccha floor and tobacco is stored on raised platforms in circular or rectangular bulk heaps with the butt ends projecting outward. The tobacco purchased from the farmers may be sorted out by the paikars and tied into hands (peti) with a good finish. The fired leaves (jala pata) and too poor leaves (*niras* pata) are removed and tied into hands separately. The wholesale merchants own large godowns made of G.I. sheets. Part of their godown floor is pucca and the rest is kuccha. Sorting grading etc., are carried out on kuccha floor whereas bulk heaps are laid on pucca floor.

The manner of constructing bulk heaps depends upon the moisture content of the leaves and the time period during which the tobacco leaf of the bulk heaps would be further processed. Usually two kinds of bulk heaps are formed, *viz.*, (i) *Kata gadi* and (ii) *chap gadi*. If the moisture content of the leaf is too high or if the prevailing weather is humid, then bulk heaps are constructed on 'Kata gadi' style. On the other hand if the weather is dry and the leaf has low moisture content then the bulk heaps are constructed on 'chap gadi' style. A kata gadi is rectangular in shape with a single continuous line of hands forming its exterior with their butt ends facing outwards. The interior is composed of narrow vertical columns separated vertically by continuous gaps 6"–8" wide between two consecutive columns. The interior of the heap is thus exposed to air currents which prevents any abnormal rise in the temperature of the tobacco. The colour of the produce may deteriorate due to overheating when the moisture content of the leaf is high. Bulks are broken and remade periodically depending upon the intensity of heat generated inside the bulk heap. The experienced workers judge the temperature of the heap by inserting the hand inside the bulk heaps at various places.

A '*chap gadi*' is also rectangular in shape and in its construction hands are placed as close as possible in a very compact manner. The construction of such a gadi keeps driage losses to the minimum. The leaf usually does not contain too much moisture and hence overheating of the bulk heaps does not take place rapidly. The bulk heaps are turned at 3–4 weeks interval depending upon the heat generated inside the bulk heaps.

Grading and Processing

The processing of the tobacco is mostly done by the wholesale merchants according to the requirements of particular consumer markets. All the hands are opened and individual leaves are sorted out broadly into four grades *viz.*, (i) Pan pata (special quality) heavy bodied heart shaped leaves of good sizes having uniform and brown colour and oily appearance. Minor physical injuries are overlooked. (ii) No. 1 (good quality) satisfactory in body, colour and oiliness. Moderate physical injuries are ignored. (iii) *Niras* (*Khandha inferior*)—Medium thin bodied, light to varigated in colour with a dry feel, dead spots and considerable physical injuries. (iv) Jala pata (fired leaves) or Khamela —leaves that do not mature properly and partly burn on the plant before harvest.

This process of grading is known as 'Chhatai.' Motihari leaves of grade (i) and (ii) may or may not be blackened by a special process known as '*Mashin gadi*.' The blackened leaves are called 'Kala' and the non-blackened leaves as 'Sada.' These kala or sada leaves of Grade I and II are tied into hands of distinctive shapes. Prior to sorting, the cluster of petioles of each hand is dipped in water by the worker with a view to bring the leaf in condition. Such tobacco is heaped by the side of each worker and sorting commenced (fig. 4). The workers are paid at Rs. 3 to 4 per md. of tobacco graded. One man is able to handle a maund of tobacco per day. These workers are professional sorters locally known as '*Atandars*' and get employment for about 4–6 months in a year. However in few big merchants' warehouses the employment is provided throughout the year.

After the leaves have been sorted, they are tied into hands (peti) of various shapes depending upon the market for which it is prepared. There are commonly four kinds of hands in vogue. They are (i) Chhati, (ii) Jugal, (iii) Chandra and (iv) *Giran*.

(i) *Chhatai* (fig. 6-*a*) : In the chhatai style a few leaves of good size and quality are first

arranged one over the other. Then leaves of medium and small size are so arranged that the small sized leaves usually come in between the medium sized leaves. The petioles of all the leaves are collected in a cluster form at one place. Before the hand is finally tied a few quality leaves of good size are placed on the upper side of the hand and the hand is finally tied. In tying quality hands usually red coloured tamaals (12" long narrow thin bamboo strip) are used. The tamaal is looped around the cluster of petioles about 1½" below their butt ends. A second loop of tamaal is given at the base of the petiole. The edges of the hands are then trimmed on all sides by a special knife removing any protruding projections. The finished hands weigh about ½ to ¾ seer. This kind of hands are more popular with Assam markets. Both motihari and jati leaves may be tied after this style.

(ii) *Jugal* (*pair*) :—[fig. 6(*b*)]—In this case the leaves are arranged in such an interlocking manner that the petioles get clustered in two bunches instead of one as in the case of chhatai. The individual cluster of petioles is secured at their base separately. The butt ends of both these clusters are then pushed nearer and tied into a single bunch by looping around a sufficiently long tamaal at their top. Thus the cluster of petioles form a pair and hence the name jugal is given to this style of tying. In appearance these hands look wider than the simple chhatai hands. Trimming of edges of such hands is done to give a regular shape.

(iii) *Chandra* (*Moon shaped*) [fig. 6 (*c*)] : Though this style derives its name from moon the hands have the shape of heart. The process involved in this case is similar to that of chhatai. The shape of the final chhatai hand conforms more or less to the shape of the largest leaf used while a chandra hand is given a heart shape along its edges by so arranging the leaves. The jugal and chandra styled hands find outlet in Assam, Calcutta and Cuttack markets and only Motihari leaves are tied in such styles.

(iv) *Giran* : In this case the bunches having 4–5 leaves originally looped for curing by the farmers and sold after spreading, are arranged as such in the hand form and finally tied as in the case of chhatai style. Such Motihari hands are preferred by Purulia markets in West Bengal, whereas jati hands find market in Assam and Tripura.

Process of blackening

For the preparation of a 'Mashin gadi' first a thick bamboo mat is laid on the floor and covered with gunny tamaal pieces etc. Then a single layer of Khandha leaf bundles is spread. The hands of tobacco to be blackened are then arranged after chap gadi style. The whole gadi is then covered with Khandha bundles all along the top and sides. The bulk heap is usually completed within 5–7 days and about 70–100 mds. of tobacco is put in one such gadi. The bulk heap is left undisturbed for about 3–4 weeks. During this period the heap develops heat inside and the leaf attain uniform dark black colour [fig. 6 (*d*)]. Khanda or Niras leaves however do not blacken at all. A certain moisture contact is necessary for the generation of adequate heat in the bulk and consequent blackening of tobacco. The blackened tobacco mostly finds outlet in Assam market.

Packing and forwarding

According to the type of demand from the various terminal markets, the processed tobacco is despatched by the wholesale merchants. The materials mainly used in packing are gunny bags and hand-made jute ropes. Usually old gunny bags are used for this purpose. The bag is cut open on long sides and converted into a strip. Two such strips are placed one over the other in a cross. At the crossing the tobacco hands are carefully arranged in a circular shape with their butt ends projecting outside. When the desired quantity ranging from one maund to 1 md. 10 srs. is thus arranged the four ends of the strips are pulled over and stitched on sides and on top. Thus a cylindrical shape bale is prepared. The bale is then tightly secured with jute ropes running along its circumference at interval. After putting the address and other required particulars the bale is ready for despatch (fig. 5) The despatch of tobacco bales to outside terminal markets is made by Rail and Air. The goods having destination points in Assam are usually despatched by rail and those for Calcutta by rail and air. The despatches by air are made from Cooch Behar and port.

System of trade with the terminal markets

The buyers from terminal markets particularly the wholesalers, visit their counterparts in the producing areas during the season and intimate their requirements to their established patrons who adjust their purchases accordingly

to meet their demand. For such transactions certain fixed percentages only are paid over and above the purchase price and incidental expenses to the local merchants. The payments are usually arranged on instalment basis.

The wholesalers of producing areas also despatch tobacco to the terminal markets for sale through their commission agents. In such cases the merchants who send the tobacco give necessary directions to the commission agents as regards to the range of prices at which the lots could be disposed off. The commission agents accordingly sell the lots at the terminal markets. The actual money value thus realised is received by the owner merchant and the commission agent is paid commission at the agreed rates. The retail sale to the consumers especially for chewing is done on single leaf basis or in small weights. After clearing the ready tobacco leaf for disposal in terminal markets through the above mentioned two agencies, the wholesalers of the producing areas still hold large stock in their warehouses and sell the same according to the demand of the terminal markets.

Mode of consumption

North Bengal tobaccos are mainly used for chewing and hookah purposes. The best grades of both Jati and Motihari tobaccos usually go for chewing and the mixture of inferior grades singly or in combination with small proportion of good leaves go for hookah purposes. Some consumers even cut a suitable sized piece from the leaf, roll the same and smoke it like cigars.

Profitableness of tobacco culture

Attempts made to collect information on the actual cost incurred and the units of bullock and men power engaged for acre did not yield satisfactory information as the growers do not maintain records of such nature. The area under tobacco controlled by individual grower, being small and tobacco fields being usually located near the homesteads, the grower and members of his family work in the fields according to their convenience with breaks in between as and when required. Hired labour is mostly engaged for such operations only, that require to be done immediately and family labour is not enough to cope with the work. The wage rates varies from Rs. 1.50 to 2.00 per adult per day plus one meal. Bullock power is employed for preparatory tillage operations only. The ploughing charges varies from Rs. 4 to Rs. 5 per day of 8 hours and includes the wages of the ploughman who brings his own plough and the pair of bullocks.

It is estimated that cultivation of Motihari and jati tobacco requires 50–60 bullock units and 225 to 250 men units per acre. The unit requirement for jati tobacco is slightly higher than motihari tobacco. The total cost of cultivation per acre comes to about Rs. 500 to 550 and 550 to 600 for motihari and jati tobacco respectively. Recently the prices per maund of 46½ srs. have ranged from Rs. 30–80 for Motihari tobacco and Rs. 40 to Rs. 100 for jati tobacco. The estimated receipts per acre come to Rs. 550 to 650 for motihari tobacco and Rs. 650 to 750 for jati tobacco. The estimated profit per acre comes to Rs. 50 to 100 for motihari tobacco and Rs. 100 to 150 for jati tobacco. Therefore, many of the marginal growers may or may not be earning any profits and perhaps may even be undergoing some losses. Their apparent cash gains largely consist of the wage of labour that the family puts in for raising the crop.

Important Problems

In the existing marketing system determination of prices are more to the disadvantage of the growers and undue profits go to the middle men and wholesalers. The low staying or withholding power of the grower due to his indebtedness, social and economic needs, force him to sell his produce immediately after the produce is ready. The time limit fixed under Central Excise rules for retaining the produce without bonding upto the end of June following the crop harvest may also be one of the factors for early disposal. This results in over supply and consequently the market prices move down. The sales taking place within this period are therefore of a forced nature and hence disadvantageous to the growers. The shrewd merchants and the band of intermediaries further aggravate the situation through malpractices.

Since in the existing cropping pattern of the tract, there is no suitable *labour intensive substitute* cash crop, the century old tobacco would continue to remain the prime favourite crop in the area for years to come. It would, therefore, be a step in the right direction if such measures which would enable the farmers to receive an increased share from the National income are taken.

Acknowledgement

The authors wish to express their thanks to Dr. N. R. Bhat, Director, Tobacco Research, Central Tobacco Research Institute, Rajahmundry for his constant interest and encouragement.

PRELIMINARY OBSERVATIONS ON THE LIFE HISTORY OF THE TOBACCO CUTWORM (Prodenia litura F.)

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The tobacco cutworm, known also as " Ladde Purugu " in Andhra Pradesh, is one of the worst enemies of tobacco nurseries in India. A pest of great economic *importance*, it enjoys a large variety of host plants in other countries also *viz.*, cotton in Egypt, mulberries in China, tobacco and castor in Indo-China and Berseem clover in Palestine, to name only a few. In India it has also been recorded as an important pest of cauliflower in Bengal by Basu (1943 and 1945).

Working on the control of this pest at the tobacco nurseries of the Central Tobacco Research Institute, it was found necessary to take up preliminary studies on the life history and habits of this pest, with particular reference to tobacco. The preliminary observations recorded here were made during 1955–56, under laboratory conditions to facilitate and assist the control studies. These observations will also help the cultivators in identifying the different stages of this pest, more particularly the different instars, of the cutworm stage, which when seen in the nurseries are often mistaken for different species of caterpillars.

The adult stage : The cutworm is the larval stage of a greyish brown hairy moth (*fig. iv*), with a patterned fore-wing. The hind wing is irradicently white with a brown horder. The body is light brown ending in a tuft of hairs.

Oviposition : Pairing takes place 2–4 days after emergence, generally in the early mornings or after dusk. Eggs are generally laid on the under-surface of the leaves but it has been observed that eggs may be laid on any surface, if leaves are not available. A single female can lay as many as 403 eggs in 2–4 clusters.

Eggs (fig. I) *:* The eggs are round and white in colour, held together in clusters, covered by small brown hairs from the body of the moth. The percentage of eggs that hatch into larvae varies from 16 to 38.

Larvae or the cutworms (fig. II) *:* The eggs hatch into larvae which pass through instars of varying colour and size. The size of the cutworms generally depends upon the type of food they eat. The following instars were bred with tender tobacco leaves.

1*st instar :* Measures about 1–2 mm. Has a black head and transparent body, sparsely covered with black hairs. This turns into the next instar within 2–3 days.

2*nd instar* (fig. II*a*)*:* Measures about 5–7 mm. It is pale green with 2 pairs of black spots, each pair on the 3rd and 5th segment. Within 2–5 days it turns into the 3rd instar.

3*rd instar* (fig. II*b*) *:* Measures about 10–12 mm. Colour pale green with an anterior darker and a posterior lighter region. The two are separated by a long black spot running across the body. Within 4–5 days it moults and turns into the 4th instar.

Fig. 1
Tobacco leaf showing the eggs.

Fig. 2
The Second, Third, Fourth and Fifth instars of the tobacco cutworm.

4th instar (fig. II*c*) : Measures about 18–22 m.m. It is darker in colour than the third instar. Three pairs of black spots appear on either sides of the anterior segments. The black head possesses a ' V ' shaped white mark Either sides of the body is darker green than the dorsal middle portion. A pair of black spots appear at the posterior end. Within

Fig. 3
The Pupa inside Soil Cocoon.

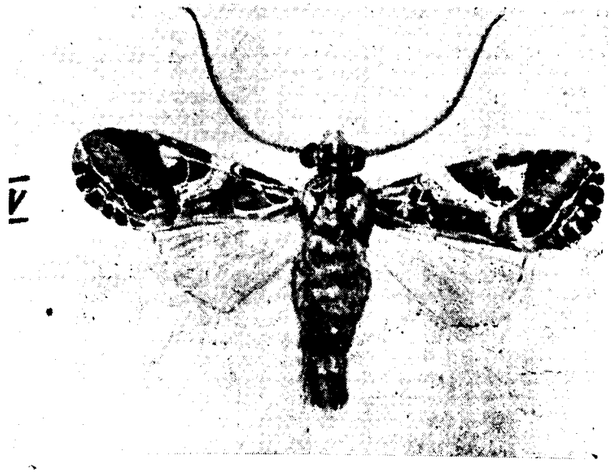

Fig. 4
The Cutworm moth Prodenia Litura F.

·5 days it moults and turns into the 5th instar rva.

5th instar (fig. II*d*) : Measures about 28– : m.m. It is a dirty grey or black slimy terpillar. often seen lying curled up in the soil. ter 2–3 days of feeding it becomes sluggish d inactive in *preparation to pupating*. It aves a soil case, with some substance exuding om its body and rests curled up inside the case d pupates.

Only 5 instars were observed during larval period. Basu (1945) recorded 6 instars on cauliflower.

Pupae (fig. III) are brown during the early period. Later when they are about to hatch colour changes to dark brown and often black. The pupal period ranges from 7–14 days during the season under study.

Fig. 5. The tobacco cutworm feeding on the tobacco leaf.

Feeding : The first instar larva feeds only on the surface tissue of the leaf. The second, third and fourth instars are voracious feeders (fig. V). The fifth instar feeds very little and lives mostly in the soil in preparation to pupating.

Summary

1. A single female can lay as many as 403 eggs in four clusters.

2. The larva which is the destructive stage generally known as cutworm passes through 5 instars, changing colour and size at every change.

3. The pupae make soil cases before pupating

4. The second, third and fourth instars are voracious feeders and do the most damage to tobacco seedlings. First instar feeds only on the surface tissue of the leaf whereas the 5th instar spends most of its time in the soil.

Acknowledgment

The author wishes to express her thanks to Dr. N. R. Bhat, Director, Tobacco Research for the facilities provided and for carefully going through the manuscript.

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WATER CULTURE IMPROVES GRADES OF TOP LEAVES IN FLUE-CURED TOBACCO

POPULAR SUMMARY

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It is the common experience of farmers that the top leaves on the flue-cured tobacco plant do not cure properly. They are slow to yellow and yet cannot be kept too long in the barn for yellowing for fear of sponging badly. Previous studies at the Institute showed that the top leaves contained less moisture than the lower leaves on the plant. It, therefore, appeared probable that the top leaves could be cured better if their moisture content was increased by water-culture.

To verify the above inference, two experiments were conducted in which about an inch of the leaf base was dipped in water for 24 hours and 6 hours respectively. For each experiment, two practically identical lots of leaf were obtained by an appropriate technique. The leaf in experiment No. 2 came from a harvest next to the one from which leaf for experiment No. 1 was obtained.

In each experiment, untreated and water-cultured leaf was cured in curing cabinets in the laboratory. The cured leaf was bulked for 15 days and then graded into farm grades.

In both the experiments, water-culture lowered the quantities of green grades and increased those of yellow, brown and light-green grades. It was found that by this water treatment the farmer could realise an extra amount equivalent to the price of about 15 lbs. of bright leaf (worth about Rs. 22 at the present rate) for every 100 lbs. of cured leaf marketed from his last pickings.

The fact that increase in bright leaf had taken place due to water-culture, was substantiated by the rise in moisture content from 81.9 per cent to 85 per cent in water-cultured leaves in experiment No. 1 and from 79.6 to 80.4 per cent in experiment No. 2.

Apart from giving a simple inexpensive method of improving the grades of top leaves, this study indicates also the importance of preserving the moisture in the leaf during all harvests of flue-cured tobacco, by such methods as covering the primed leaf with wet gunnies till it is actually taken up for stringing, and loading into the barn as early as possible thereafter. Enterprising farmers may try to increase the moisture content of the top leaves by pot watering the plants early in the morning and harvesting the leaf in the evening when it is expected to contain higher quantities of sugar which would be favourable for quality.

NEW METHODS BRING HANDSOME PROFITS IN FLUE-CURED VIRGINIA TOBACCO

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Growers of flue-cured Virginia in Andhra Pradesh are well aware that the Companies buying tobacco for the British manufacturers are, in recent years, ill at ease with the quality of the leaf, more especially, its size, body and stretchiness. This is adversely affecting the prices they realise for their produce except when an unexpectedly heavy demand arises out of short-fall in the market. This happening when the cost of production has risen very high owing to abnormally high land rent and high labour charges and the per acre yields have remained low and are thought to be even falling. Manuring either with nitrogen alone or with a complete fertiliser has not solved the problem of either quality or yield to any appreciable extent. This is an impasse which deserves an immediate solution if flue-cured Virginia growers are to be saved from an imminent economic disaster.

The Central Tobacco Research Institute has taken up the challenge, and has been carrying out studies and research on the problem during the last two seasons. A study of the data on manurial experiments conducted on the research farms at Rajahmundry and Guntur during a number of seasons revealed that the crop was suffering from a chronic deficiency of soil moisture during the active period of its growth. This was the all important reason, apart from others, *e.g.*, lack of crop rotation, why it does not put up good growth and does not respond to fertilisers. It was, therefore, thought that in the absence of irrigation facilities which are very scarce in the tract, the possibilities of improvement lie in the direction of making the soil absorb more moisture during the preceding monsoon, preventing the loss of soil moisture taking place mainly through evaporation, and placing fertilisers at such a depth in the main root zone where there is adequate supply of moisture. Three important measures which would mainly serve these objectives in addition to being useful in other respects were tried. They were—

(1) Deep (9″) ploughing in summer—for better absorption of moisture, better soil aeration and better soil nitrification.

(2) Deep (6″ to 9″) placement of fertilisers to supply the nutrients in the lower layers of the soil where there is adequate moisture and where the roots feed during the active period of plant growth.

(3) Mulching after the first interculturing —to prevent rapid evaporation of moisture from the surface layers of the soil.

Striking improvement resulted from these measures, both individually and together, in yield as well as quality which went hand in hand, during both the seasons of trials at Rajahmundry as well as Guntur.

In the different experiments in which the individual treatments were tried in the two seasons, they gave average cured and bright leaf increases mentioned against them below :

	Rajahmundry		Guntur	
	Cured leaf	Bright leaf	Cured leaf	Bright leaf
	(Percentage increase)			
Deep ploughing ...	13.8	21.7	11.5	33.0
Deep placement ...	16.8	25.3	15.0	32.4
Mulching ...	7.2	13.3	...	...

Yields obtained from an experiment conducted in 1957–58 at Rajahmundry, in which the treatments were, for the first time, combined in all possible ways, and the estimated cash returns are reproduced below :—

	Yield in lbs. per acre		Estimated cash returns
	Cured leaf	Bright leaf	
			Rs.
1. Cultivated as in the farmers' way (Control) ...	825	363	720
Improved cultural treatments :—			
2. Only deep ploughing in summer	981	438	908
3. Only deep (6") placement of fertiliser—(N. 20 lbs. P_2O_5 100 lbs., and K_2O 50 lbs.)	990	427	957
4. Only mulching after one interculturing ...	1,100	572	1,166
5. Deep ploughing plus deep* placement of fertiliser	893	361	792
6. Deep ploughing plus mulching	1,223	504	1,133
7. Deep placement of fertiliser plus mulching ...	1,016	482	1,023
8. Deep ploughing plus deep placement of fertiliser plus mulching	1,263	629	1,205

The above data have been given for only rough guidance.

Deep ploughing (about 9" deep) may be done either with a tractor or by hand digging. But, to realise its benefits, it is most important to *do it as early as possible in summer*. Deep ploughing during and after the monsoon has been found to lower the yield.

For deep application of fertiliser, a simple, (two) bullock drawn implement has been devised at the Central Tobacco Research Institute, by Dr. N. R. Bhat (Director) and Shri Kameswara Rao (Engineer). Blue prints and particulars of the implement have been supplied to the Assistant Tobacco Extension Officers, Guntur and Eluru from whom they can be had. The cost of fabrication of the implement is expected to be about Rs. 150.

For mulching, paddy straw was used as it was convenient to handle. But, farmers can use any other readily available material, *e.g.*, grass, twigs etc. About 3 cart-loads of paddy straw costing about Rs. 50 was used per acre.

* The yields in this treatment seem to have fallen due to weed infestation in one replication

It is most important to *mulch early after planting before the moisture from the top soil has evaporated*. The appropriate time is after the first interculturing with a bullock drawn hoe about 3 weeks after planting.

Yields increase further due to topping. Topping has to be done judiciously looking to the size and condition of the individual plants. Topping is inadvisable in the case of a plant of which the mature leaves look green. In suitable plants it should be done when a small portion of the inflorescence has appeared. The level at which topping is to be done is to be decided on the basis that all leaves which are likely to go into low grades after curing deserve to be removed.

There is an additional item of improvement which needs a mention. It is well recognised that humus is very beneficial for flue-cured Virginia tobacco from the point of improving the physical structure of the soil, absorption of moisture and its even distribution to the plants. Experiments carried out at the Central Tobacco Research Institute Farm at Rajahmundry have shown that tobacco stalk compost serves as a very good source in this respect. Other treatments (including deep ploughing, complete fertiliser and mulching) being equal, application of tobacco stalk compost (which has been composted for only 3 months from May to July) at the rate of 5 tons per acre gave a yield of 1,542 lbs. against 1,399 lbs. obtained in the plot without it. In the former plot, leaves were even as big as 32" × 22". Grade per grade, the colour was more flashy and the leaf more elastic. These are, indeed, covetable results to be obtained under rainfed conditions.

It will be very paying for flue-cured Virginia growers to adopt at least some, if not all, of the above cultural improvements which they can afford for improving the yield and quality of their tobacco. In doing so, they will also be enhancing the prestige of the Indian tobacco in markets abroad and helping the country in earning more foreign exchange.

The experiments from which the data and information have been given above were carried out with the active co-operation of Shri H. T. Khomchandani (formerly) Agronomist at the Central Tobacco Research Institute, Rajahmundry, Shri R. Anantaraman, Technical Assistant to the Director, Tobacco Research, and Shri S. Viswanadham, Plant Breeder, Cigarette Tobacco Research Sub-station, Guntur to whom the writer is grateful.

This is published in the form of leaflets in English (No. 22) and in Telugu (No. 20)

OUR NEW MEMBERS

Name		*Representing*
1. **Shri Moolchand Dube,** M.P.	...	*Tobacco Growers in Uttar Pradesh.*
2. **Shri Anil Barva**	...	*Tobacco Growers in Assam.*
3. **Shri Baloo Ram,** M.L.A.	...	*Tobacco Growers in Punjab.*

UNWANTED TYPES OF FLUE-CURED TOBACCO—A KEY TO THEIR IDENTIFICATION

N. R. BHAT[1] AND I. V. G. KRISHNAMURTY[2]

Of late, cultivation of unrecognised and undesirable flue-cured tobacco types is on the increase. *Karedu* and *Putcha* are the important and widely cultivated amongst such types. *Guba* and *Dhone* are the synonyms for *Putcha* in certain places and in other areas they seem to be slightly different. Still in other places *Putcha* is used as a synonym for *Karedu* which makes the whole nomenclature of these types confusing and identification difficult. Some people call *Putcha* as *Putcha Vittanam* and *Karedu* as *Karedu Vittanam* to make matters still worse.

The exact origin of these types is not known and they have not been systematically assessed for the quality of their leaf. Further, it is reported that the cured leaf of these types loses its colour fast during storage which is a very undesirable feature. For these reasons, the trade is averse to the purchase of their leaf. Of late, the Indian tobacco has been losing its value and prestige in foreign markets due to admixture with these unwanted types and we may soon lose the market if the mistake is not rectified in time by not growing these types. Cultivators are well aware that nearly 80 per cent of the flue-cured tobacco produced in India is exported to foreign countries and we have to depend very much on their opinion if we have to continue our production at least on the existing level.

During the last season, a large number of cultivators grew these undesirable types. They were grown largely in certain villages where the soils were found to be generally unsuitable for the cultivation of the standard types like Harrison Special or Chatham. Further, the popular belief that these types give more bright leaf which, to some extent, is true because of their thin leaf is helping in their spread to other areas which normally grow Harrison Special or Chatham successfully. Thin leaf is very undesirable in flue-cured tobacco even in spite of its good colour. Further, as the mongrel types are still segregating, their leaf will not be of a uniform quality but will be an undesirable mixture of different qualities unsuitable for manufacturers. It has also been the experience of cultivators that these types are more susceptible to diseases and pests and suffer heavily during adverse seasons. Besides, they are neither steady in their performance. It is surely unwise to grow these types which have so many demerits simply because they give more bright leaf in favourable seasons in some areas.

During the last season, some cultivators raised these types unknowingly because these seedlings were sold to farmers as of standard varieties by some unscrupulous nurserymen. It is difficult to distinguish these types in the seedling stage but when fully grown they can be identified fairly well. A general comparative description of each type along with that of each of the two standard types Harrison Special and Chatham in the grown up stage is given below for the guidance of the cultivators.

1. Director, Tobacco Research. 2. Training and Demonstration Officer, Central Tobacco Research Institute, Rajahmundry

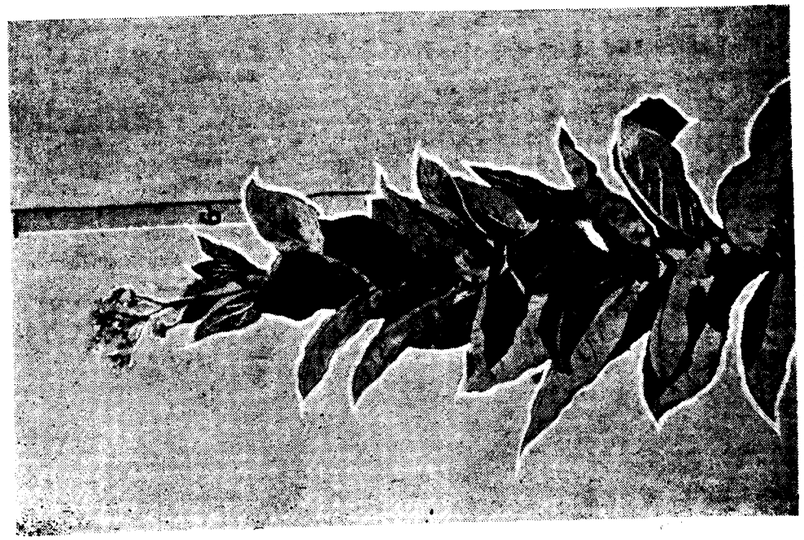


Fig. 2—Chatham

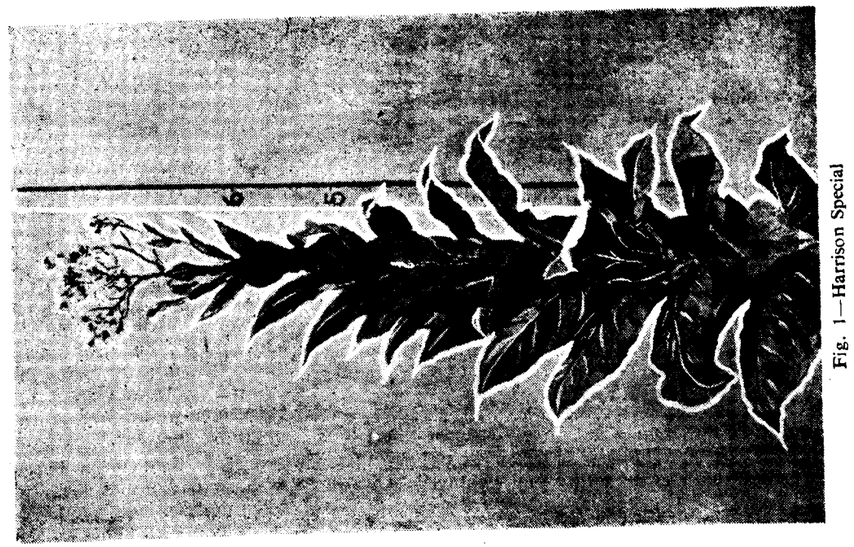


Fig. 1—Harrison Special

I. *Character*	*Harrison Special* (Fig. 1)	*Karedu* (Fig. 3)
Plant height	Five to six feet in fields of average fertility.	Tall, often reaching about seven feet in height.
Leaf ...	Lanceolate to broad lanceolate in shape with a broad base and acute tip.* The angle of attachment of the leaf to the stem is a little over 45°.*	Lanceolate in shape with a comparatively narrow base and a drawn out tip.* The angle of attachment is near about 90° giving an appearance of almost horizontal attachment.*
	Top leaf is average in size. Fairly thick leaf.	Top leaf is much smaller in size. Thin leaf.
Auricle ...	Size of auricle—average.	Size of auricle—Smaller.
Internode ...	Average sized.*	Unusually long.*
Peduncle ...	Average in size.*	Long and naked.*
Panicle ...	Somewhat loose.*	Very loose.*
Diseases and pests	Not very susceptible to diseases and pests.	Appears to be more susceptible to diseases and pests, particularly to powdery mildew and aphids.

II. *Character*	*Harrison Special* (Fig. 1)	*Putcha* (Fig. 4)
Plant height ...	Five to six feet in fields of average fertility.	The majority type is similar to Harrison Special but a few segregants are found to grow tall.
Stem colour ...	Green in early stages and pale yellow when mature.*	Cream colour in early stages and whitish when mature.*
Leaf ...	Shape lanceolate to broad lanceolate. Tip acute.*	Shape lanceolate. Tip blunt.*
	The top 1/3 of the leaf generally bends back giving a characteristic appearance to the plant.*	The edges of the leaf roll back right up to the tip which gets a beak-like appearance. The leaf is folded upwards slightly along the midrib giving a boat-shaped appearance. The leaf area between the primary veins bulges upwards giving an uneven surface. Occasionally the leaf is twisted slightly to one side.*
	The leaf is green in colour when immature and light yellow when mature.	The leaf is light green in colour when immature and flashy yellow when mature.
	Thickness—average.	Comparatively thin.

Midrib ...	Green when immature and pale yellow when mature.	Cream colour when immature and almost whitish when mature.
Auricle ...	Average sized.	Comparatively bigger in size.
Internode ...	Length average throughout.	Internodes shorter at the base and of average length at the top.
Diseases and pests.	Not very susceptible to diseases and pests.	Appears to be more susceptible to diseases and pests, particularly to powdery mildew and aphids.

Fig. 3—Karedu

Fig. 4—Putcha

III. *Character*	*Chatham* (Fig. 2)	*Karedu* (Fig. 3)
Plant height ...	Five to six feet in fields of average fertility.	Tall, often reaching about seven feet in height.
Leaf ...	Ovate to broad ovate in shape. Tip round.*	Lanceolate in shape. Tip acute and drawn out.*
	Maximum width is in the centre of the leaf.	Maximum width is at about one-third the length from the base.
	The angle of attachment of the leaf to the stem is less than 45° which gives a ' stand up ' appearance to the leaves.*	The angle of attachment is near about 90° giving an appearance of nearly horizontal attachment.*
	The leaves are almost erect but the margins fold back giving a hooded appearance to the leaf.	The top half of the leaf bends slightly back.*
	The top leaves are fairly big in size.	The top leaves are much smaller.
	Thickness—average.	Appears to be comparatively thin.
Auricle ...	Average sized.	Smaller in size.
Internode ...	Length average.	More in length.
Panicle ...	Compact with little branching.*	Loose and much branched.*
Peduncle ...	Average sized.*	Long and naked.*
Diseases and pests.	Not very susceptible to diseases and pests.	Appears to be more susceptible to diseases and pests, particularly to powdery mildew and aphids.

IV. *Character*	*Chatham* (Fig. 2)	*Putcha* (Fig. 4)
Plant height ...	Five to six feet in fields of average fertility.	The majority type is similar to Chatham but a few segregants are found to grow tall.
Stem colour ...	Green in early stages and pale yellow when mature.*	Cream colour in early stages and almost whitish when mature.*
Leaf ...	Ovate to broad ovate in shape with a round tip.*	Lanceolate in shape with a blunt tip.*
	The maximum width is in centre of the leaf.	Maximum width is at about one-third the length from the base.
	The angle of attachment of leaf to the stem is less than 45° which gives a ' stand up ' appearance to the leaves.*	The angle of attachment is more than 45°.
	The leaves are almost erect but the margins fold back giving a hooded appearance to the leaf.*	The edges of the leaf roll back right up to the tip which gets a beak-like appearance. The leaf is folded upwards slightly along the midrib giving a boat-shaped appearance. The leaf area between the primary veins bulges upwards giving an uneven surface. Occasionally, the leaf is twisted slightly to one side.*
	The top leaves are fairly big in size.	The top leaves are comparatively smaller.
	The leaf is green when immature and yellowish when mature.	The leaf is light green when immature and flashy yellow when mature.
	Leaf thickness average.	Leaf appears to be thin.
Auricle ...	Average in size.	Comparatively bigger in size.
Midrib ...	Green in immature leaf and whitish yellow in mature leaf.*	Cream colour in immature leaf and almost whitish in mature leaf.*
Panicle ...	Compact with little branching.*	Loose.
Diseases and pests.	Not very susceptible to diseases and pests.	Appears to be more susceptible to diseases and pests, particularly powdery mildew and aphids.

Unwanted Types of Flue-cured Tobacco

V. *Character*	*Harrison Special* (Fig. 1)	*Chatham* (Fig. 2)
Leaf	Lanceolate to broad lanceolate in shape with an acute tip.*	Ovate to broad ovate in shape with a round tip.*
	Maximum width of the leaf is at about one-third length from the base.	Maximum width is in centre of the leaf.
	The angle of attachment of the leaf to stem is more than 45°.	The angle of attachment of the leaf to stem is less than 45° which gives a 'stand up' appearance to the leaves.*
	The top one-third of the leaf generally bends back giving a characteristic appearance to the plant.*	The leaves are almost erect but the margins fold back giving a hooded appearance to the leaf.*
	The top leaves are comparatively smaller.	The top leaves are comparatively bigger.
Internode ...	The internodal length is average.	The internodal length is shorter.
Panicle ...	Comparatively loose with much branching.*	Compact with little branching.*

NOTE.—Characters marked with asterisks are easy for farmers' identification.

This Institute has already published and distributed leaflets appealing to the cultivators not to grow these undesirable types. A general description of these types as compared to the standard types is being given in popular language with the hope that it will help the tobacco extension staff and growers in identifying the unwanted types for elimination from cultivation in future.

This is published in the form of leaflets in English (No. 23) and in Telugu (No. 19).

THE DEEP FERTILISER

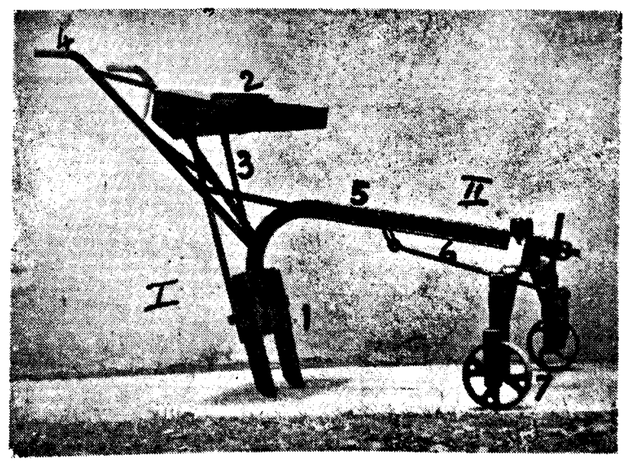
N. R. BHAT[1] AND K. KAMESWARA RAO[2]

Deep placement of fertiliser, whether only nitrogenous or complete (N, P and K), had been found to improve the yield as well as the leaf quality of flue-cured Virginia tobacco in Andhra Pradesh. Such application has raised the cured leaf and bright leaf yields by over 15 and 25 per cent respectively at the Central Tobacco Research Institute, Rajahmundry. This is in conformity with the results of numerous 'placement' experiments carried out on certain other crops elsewhere in the country and abroad.

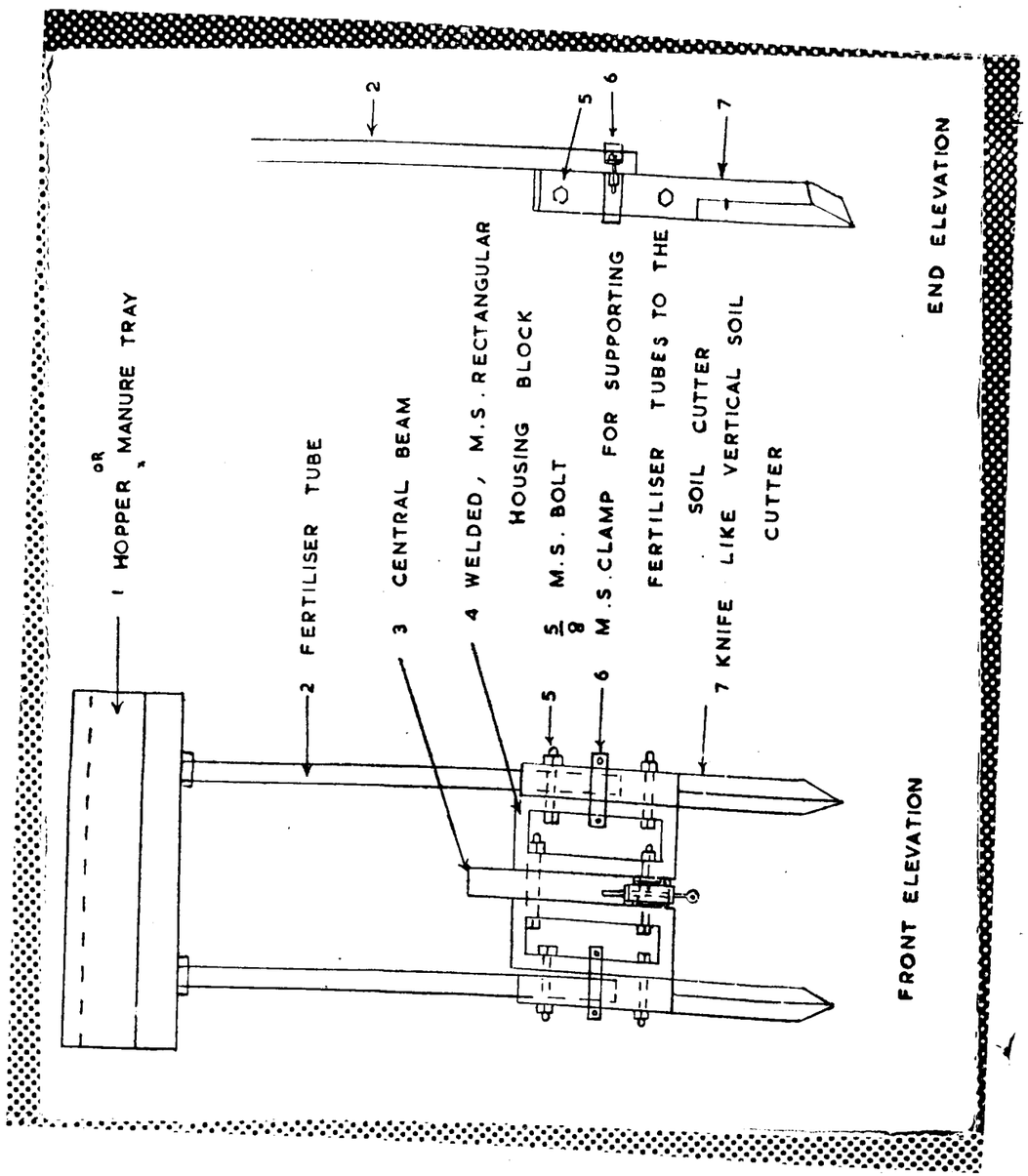
The rainfed flue-cured Virginia tobacco grown in Andhra Pradesh develops a deep root system to be able to feed in the sub-surface soil which contains adequate moisture required for absorption of nutrients, during the active period of its growth. Naturally, therefore, highly beneficial results are to be expected when fertilisers are applied by placement at a depth of about 6" to 9" in the sub-surface zone.

A number of power driven implements have been devised in foreign countries for deep placement of fertilisers, but they are not easy and cheap for use by our farmers. Though deep placement of fertilisers should be very beneficial even to other deep rooted rainfed crops, *e.g.*, cotton, chillies, pigeon pea and other tobaccos, in our country, the benefits that would result from the operation do not seem to have been sufficiently well visualised. The authors are not aware of any simple bullock drawn implements having been devised for the purpose. For this reason, they felt it necessary to devise one for the immediate need of tobacco. It has been named the "Deep Fertiliser."

The implement consists of two assemblies, (1) a rear assembly consisting of (i) the deep fertiliser, (2) a hopper for the fertiliser, (3) two numbers of fertiliser dropping tubes connected to the bottom of the hopper, and (4) operating handles for the implement, and (ii) the yoke assembly in the front comprising (5) a central beam (6) a central tie-rod for hitching the implement to the yoke, to which are attached,



1. Director, Tobacco Research, 2. Engineer, Central Tobacco Research Institute, Rajahmundry.



(7) two wheels one on either side for steadying and guiding the implement.

The deep fertiliser in the rear assembly comprises two solid heavy rectangular welded steel housing blocks, securely connected by bolts and nuts to either side of the central beam. To these blocks are attached the two soil cutters which are also of mild steel bars of $2\frac{1}{2}'' \times 1\frac{1}{2}''$ sections and 17" long with the profiled cutting edges at the bottom as shown in the Figure.

Just above the central beam, in front of the two wooden handles, is the hopper or the manure tray, made out of thin galvanised iron sheet, for filling up the fertiliser. The hopper is in two chambers with a sliding vertical partition in the centre. In one of the chambers a measured quantity of fertiliser sufficient for a certain number of rows is put. The second is the feeding chamber. The feeding chamber has two openings provided at the bottom, to which are connected two numbers of 1" diameter tubes by means of welded couplings for the dropping of the fertiliser. These tubes are firmly clamped to the hind side of the two soil cutters as shown in the Figure. Special mention may be made here of the fact that the lower ends of the tubes are purposely kept above the soil surface to prevent the tubes from getting either clogged or obstructed by the soil.

The implement works in the following manner:

The two soil cutters secure a cut of at least 6" in the soil, when it is in a condition fit to receive the fertiliser for the tobacco crop either at planting time or earlier upto a month prior to planting. It works in a simple manner like a plough and with the power of only a single pair of bullocks. When the implement is yoked and is drawn by the bullocks, the soil cutters secure two deep cuts in the soil. The required depth of at least 6" of the cuts in the soil will be maintained by applying weight, *e.g.*, by loading the beam at the foot of the handle with one or two sand bags as may be required. When the deep cuts are being made, the farmer will be dropping the fertiliser by his hand, at the required rate into the feeding chamber and the fertiliser will pass down the two tubes and drop instantaneously to the bottom of the deep cuts, closely behind the soil cutters, before the cuts will be covered by loose soil from their sides.

Thus, the implement secures placement of the fertiliser at the required depth, in parallel lines on either side of the planting strip. When, later on, the crop row is planted along the centre of the strip, it will be having the fertiliser lines 6" away on either side.

CIGARETTE TOBACCO NURSERIES ON HEAVY BLACK SOILS

Hints to Farmers

If you are a cigarette tobacco grower, particularly in Andhra Pradesh, here is something for you to think about. You can be proud of having been able to raise a difficult cash crop like Virginia tobacco, but you cannot raise your own nurseries. As a good farmer, you know the value of transplanting healthy seedlings at the correct time but you are content to plant stale seedlings of doubtful origin purchased from distant places. Cigarette tobacco buyers abroad insist now on better quality. This cannot come out of stale seedlings.

Excessive 'damping off' in your black soils has no doubt killed your enthusiasm for raising nurseries *But you had never tried to prevent the disease.* You had always tried to check the disease after it had appeared. "Damping off" can be controlled *more by prevention than by cure.*

Raising your own seedlings is like producing your own milk. In either case, you can be sure of purity, healthiness and quality. It may also mean some saving in cost. It is *difficult but not impossible* to raise nurseries in black soils. Here are a few hints that will help you. *Make a start this season.*

1. *Site and lay-out :* Choose high level with a gentle slope. Burn the selected area with either straw or any other easily available litter, *e.g.*, tobacco roots. This will kill weed-seeds, seeds of off types sown in previous seasons, and soil borne diseases and pests. In addition, the soil will be rendered friable. Mix the ash with the soil. Mix 50–100 tons of river sand to facilitate drainage. Plough to fine tilth. Prepare beds raised by 6". Width should be 3½' and length according to convenience.

Note the blank beds resulting from complete destruction of seedlings by "damping off" where no fungicide was applied.

2. *Basal manuring :* Groundnut cake and farmyard manure are very good basal manures for tobacco nurseries. For supply of nitrogen, apply groundnut cake at the rate of 1200 lbs. per acre. If you are applying groundnut cake, apply powdered groundnut cake, two to three weeks before sowing and mix well with the soil. This will make it readily available to the young seedlings. The quantity to be applied is about 8 ozs. for every length of 5 ft.

Farmyard manure should be applied just prior to sowing and preferably after powdering and sieving. Treat it with Bordeaux mixture or Perenox to prevent it from being a source of 'damping off'. It has been found to give large number of healthy and vigorous transplants if farmyard manure is applied as 1" layer on top of the nursery beds.

3. *Preventive dose :* Two or three days before sowing, spray Perenox (2 in 10)* or Bordeaux mixture (2–2–50) as a preventive dose against 'damping off.' Spray at the rate of about a gallon for 10 square yards.

4. *Sowing :* Seed rate should be about 3½ lbs. per acre or 1¼ tolas per cent. Higher seed rates will only satisfy the eye immediately after germination *but the satisfaction will be shortlived.* Mix the seed with fine sand to make up to a large quantity and to ensure even distribution of seed over the beds. After sowing, stir the surface very gently with tips of the fingers and then roll a cement pipe 3½′ × 1′ twice to press the seed against the soil and to even out the surface.

5. *Use pure seed :* Always use pure certified seed. Pure treated and processed seed produced at the Institute is kept for sale with the Secretaries of the Market Committees of Krishna, East and West Godavari districts, and also with the Assistant Tobacco Extension Officer, Guntur and Eluru (West Godavari). Pure seed will save the growers from undesirable mixtures which will include bad quality leaf in their harvest.

6. *Watering :* Use rose cans with fine holes. Do not splash water from pots. Well water, if easily available, is better than pond water.

7. *Top dressing about the 5th week after sowing :* To force growth, if necessary, apply 1¼ tola of sulphate of ammonia per square yard in half the quantity of water required for one watering followed by the remaining half quantity to wash off sulphate of ammonia from the leaves. After each pulling apply the same dose to push on the growth.

8. *Cutworms and caterpillars :* As soon as you see any tiny caterpillars, spray with rose can D.D.T. 50% W.P. Five tolas of D.D.T. in one kerosene tin of water should be enough for 30 square yards of nursery. Second spraying may not be necessary.

9. *Control of 'damping off': Remember you are to prevent 'Damping off' from appearing and not think of taking measures after it had appeared. If you are that type of farmer who goes in search of perenox, or copper sulphate and lime after the disease had appeared, it is better you do not think of raising a nursery.*

If the weather is clear, spraying may be done once in 5 to 7 days from the time the germination is complete upto about a month. Spray (2 in 10) Perenox or (2–2–50) Bordeaux mixture at the rate of a gallon for 10 square yards. Under prolonged or recurring wet conditions, the application should be repeated frequently. Remember that the object is to maintain some quantity of Perenox or Bordeaux mixture in the soil so that "damping off" will not set in. The rains wash it off every time and hence the need for the repetition.

10. *General :* Before weeding it is better the labourers wash their hands with soap and water as they may pass on mosaic disease. Spray D.D.T. a day before pulling out seedlings so that caterpillars are not carried from the nursery to the field.

Now make a start with your own nursery in the ensuing season. Good quality seeds and further information, if any, can be obtained from Director, Tobacco Research, Central Tobacco Research Institute, Rajahmundry, Plant Breeder, Cigarette Tobacco Research Sub-Station, Guntur and Assistant Tobacco Extension Officer, Guntur.

Preparation of Bordeaux mixture and Perenox

Bordeaux mixture : Dissolve 1 lb. (40 tolas) of well powdered copper sulphate in 20 gallons (5 kerosene tin fulls) of water in an earthen pot (Metal vessels of any type such as iron, brass, aluminium or tin should not be used). Prepare in another earthen pot lime solution by adding 1 lb. of *freshly prepared quick-lime* to 5 gallons of water and dissolve till a uniform milky mixture is formed. It is essential to use freshly prepared quick-lime. Lime from old stocks will be of poor quality and will result in poor quality Bordeaux mixture.

Pour copper sulphate solution *slowly* into lime solution stirring well all the time with a stick. Constant stirring is essential to prepare good quality Bordeaux mixture*. 25 gallons of Bordeaux mixture are now ready for application.

Perenox : This is in powder form and is sold in package of various sizes by the Imperial Chemical Industries. First prepare a paste of Perenox by mixing half a lb. (20 tolas) of the chemical with a small quantity of water. While preparing the paste stir the mixture well. After the paste is thoroughly prepared, add enough water to make up the volume of the fungicide to 40 gallons (10 kerosene tin fulls) for spraying.

* Dip a clean bright blade of a knife in the mixture for about ½ a minute. If it appears rusty, add more lime solution to the mixture and stir well. Repeat the test and continue adding lime until no rusty coating is seen on the blade.

Note :—This is published in the form of leaflets in English (No. 15) and in Telugu (No. 15).

GERMINATION OF TOBACCO SEED IMPROVES BY PRE-SOAKING

It has been proved that even when perfectly viable seeds are used, germination may still be sometimes defective in the nursery. There are two principal causes for this :

(1) During the sunny part of the day the surface layer of the soil is heated up to a very high temperature which is detrimental to good germination ; and

(2) Inadequate watering soon after sowing leads to a partial drying up of the soil and the embedded seed finds it difficult to germinate.

Both of these causes are aggravated, if there is no rain during the two or three days immediately after sowing.

Research at the Institute has indicated how cold temperature treatment of the seed before sowing can improve the situation and good germination can be obtained. The details of the method are dealt with in an article published in the *Indian Tobacco*. The method may be adopted by farmers who have a refrigerator available with them for treating the seed to a cold temperature.

Many of our farmers, however, do not have this facility. For them a very simple method has been devised for treatment of the seed. Repeated trials have proved that although this method is not as efficient as treatment to cold temperatures, it is nevertheless very useful in producing good germination in the nursery.

The method consists of simply soaking the seed for 3 to 6 days as required before sowing. The soaking should be carried out in such a way that the seed is not submerged and yet supplied with enough moisture.

Take a flat-bottomed tray, say 12″ × 15″ and put two layers of hessian and a layer of muslin over it. Pour sufficient water so that the hessian and the cloth is fully wet without overflowing of water. Spread a matchbox full of tobacco seed (12 to 14 gms.) uniformly over the entire surface. Add a little more water from the sides if necessary, without disturbing the seed. Cover the tray with a glass plate and keep in a cool place. It may be advisable to keep it in the open in the night and take advantage of the cooler temperature but during the day it must be kept indoors in a cool place away from the direct sun. Replenish water in the tray once a day to keep the seed always in a moist condition.

Depending on the dormancy of the seed and the temperature the seed will begin to show signs of germination in about 3 to 6 days' time. At the stage when the seed coat breaks and white radicle begins to make its appearance in most of the seed, the seed should be removed and mixed with dry sand and sown in the beds in the usual way. There will be no harm if there be a few seeds that may have slightly advanced in development. Seeds from each tray will be sufficient for 1 cent of nursery. It is necessary to complete the sowing as early as possible after removal from the tray. If the nursery is situated at a distance, it is advisable to carry the tray with the seed to the nursery for sowing. Mixing with the sand will be facilitated if the seed is removed from the tray and is allowed to dry for a few minutes in shade. The drying should be just enough that the seed does not form small lumps and, when touched comes off as individual seeds without sticking on to the hand. Avoid exposure to direct sun at all stages. On a sunny day, it is better to sow the seed in the evening after 4 p.m., to avoid sowing in the

heated-up beds. After sowing, the beds are to be watered copiously and kept continuously wet until germination is complete.

If this method is followed, the germination will be visible within 3 to 5 days of sowing instead of 7 to 8 days normally required for unsoaked seed. This will cut short 3 to 4 days watering and reduce the watering cost, thus amply compensating for the extra labour required for pre-soaking of the seed. Besides, it will enable the farmer to obtain better and more uniform germination and safeguard to a certain extent against the adverse effect of a hot and dry spell of weather, if any, immediately after sowing.

This has been published in the form of leaflets in English (No. 21) and in Telugu (No. 18) for distribution to the growers.

WORLD TOBACCO CONGRESS, BRUSSELS

The Brussels 1958 World Fair, organised a scientific congress to bring together scientists and technicians representing all aspects of the tobacco industry—agriculture, manufacture and distribution. The object of the congress was to provide a meeting place for the exchange of ideas and to enable research workers of many countries to correlate their efforts.

About 350 delegates representing 40 countries attended. These included many representatives from British Tobacco Companies and from Commonwealth Countries. A whole city was built by architects, using the most exciting new techniques of modern architecture to house the exhibits of many nations.

The congress was officially opened at a luncheon in one of the halls of the World Exhibition. Speeches of welcome were made by the Belgian Minister for Economic Affairs and by M. Jacques van Zuylen, President of the Tobacco Industry Group of the Brussels Universal Exhibition.

Under the slogan " Man and Tobacco in the year 1958 " some impressive facts were given. Some 60 million of the world's population earn their living in the growing, processing and distribution of tobacco. The dramatic rise of world cigarette consumption is shown by the following figures :—

			Million.
1939	...	...	528,000
1951	...	...	1,068,000
1956	...	...	1,200,000
1958 (estimated production)		...	1,750,000

The working sessions of the conference were held in the new Congress Hall. Proceedings were in English and French, and all lectures and discussions were simultaneously translated.

The programme was divided into five sessions, each with its individual theme.

The first theme was " Virus Diseases of Tobacco ". The report dealt with a world-wide inquiry of different aspects of various diseases affecting tobacco and ways of combating them and growing resistant varieties of tobaccos without affecting the quality of the leaf produced.

The second theme was " Tobacco and Water ", the third theme was " Tobacco with low Nicotine content ", while the fourth was " Tobacco smoke " and the final theme was " Tobacco Fermentation. "

In addition to the general reports, individual contributions were presented at each session by contributors from many research organisation.

The congress was of great value in establishing greater collaboration between various branches of the industry and between scientists working on similar subjects in different places and in establishing the need for standardization of testing techniques to permit a free exchange of tobacco knowledge.

(*Source :* Tobacco Monthly Trade Journal August 1958).

HOMOGENIZED TOBACCO LEAF*

Some three years ago the General Cigar Company, Inc. U.S.A. announced for the first time a major new development in the cigar industry—the production of Homogenized Tobacco Leaf (HTL). At that time production of this new product was begun on a modest scale in Lancaster, Pennsylvania and introduced to the public in a new five-cent cigar. Today the manufacture of HTL has expanded to a point where there are two plants producing HTL for General Cigar. In addition, the General Cigar has licensed major cigar manufacturers in the United States and abroad, many of whom are already manufacturing and using this unique new tobacco products.

HTL was invented by the late Dr. W. G. Frankenburg, Vice-President in Charge of Research and Development of the General Cigar Company, Inc. It is a product of painstaking research carried out at the company's research laboratory in Lancaster. In the course of his studies on the chemistry of the tobacco leaf, the late scientist made discoveries which were of practical and scientific importance to General Cigar and to biochemists throughout the world.

Mr. Julius Strauss, President of General Cigar says, " HTL, as our new patented product is called, offers substantial savings to cigar manufacturers in both raw materials and labour costs, both of which have been squeezing profits in the industry". It has received an enthusiastic acceptance by the American public and tests show that cigar smokers throughout the world are also expressing a preference for this new product.

First used as Binder on Five-Cent Cigar

The first commercial application of HTL was as a binder for a new cigar which was introduced in the low-price field. Since its initial introduction in two test market areas, one in the mid-west, the other in Buffalo, New York, the demand for this cigar increased rapidly. Today, it is sold throughout the country at a still expanding rate.

One reason for the wide acceptance of this new five-cent cigar is its carefully selected blend of mild tobaccos which together with HTL produce a cigar regarded by the manufacturer as the mildest cigar ever made. The steady increase in sales of this cigar has led General Cigar to gradually increase its production of the Brand and to expand its production of HTL, until today the company has two plants producing it, one in Lancaster and the other in Mahanoy City, Pennsylvania. These plants are producing the new type of binder tobacco around the clock, five days a week, supplying binders for all of General Cigar's brands. HTL was incorporated in all the company's brands late in 1955.

Process uses High Quality Tobacco

The first thing visitors see when they are taken through the HTL production plant is the preparation of a finely ground tobacco powder, called by the company " tobacco flour". This tobacco flour is produced by passing a blend of whole tobacco leaves and pieces of broken leaves derived from various sources, (such as broken pieces from high quality tobacco going into the filler of cigars, from tobacco damaged by storm when still in the farmers' field, etc.), and defective leaves (leaves having holes or poor colour but otherwise of good smoking quality), through a drying tunnel. The dried tobacco is then fed into grinders which produce as a final product the tobacco flour. This finely ground powder resembles in consistency the cake flour used by housewives for baking. The tobacco flour is stored in fibre drums until ready for use.

The next phase of the production of HTL shown to visitors is the preparation of a thick syrup resembling in colour and consistency a chocolate sauce. This is called the tobacco dough. Although the development of the best grinding procedure was an important achievement, the steps in preparing the tobacco dough constitute the most critical part of HTL manufacture.

* From General Cigar Co., Inc., New York (U.S.A.)

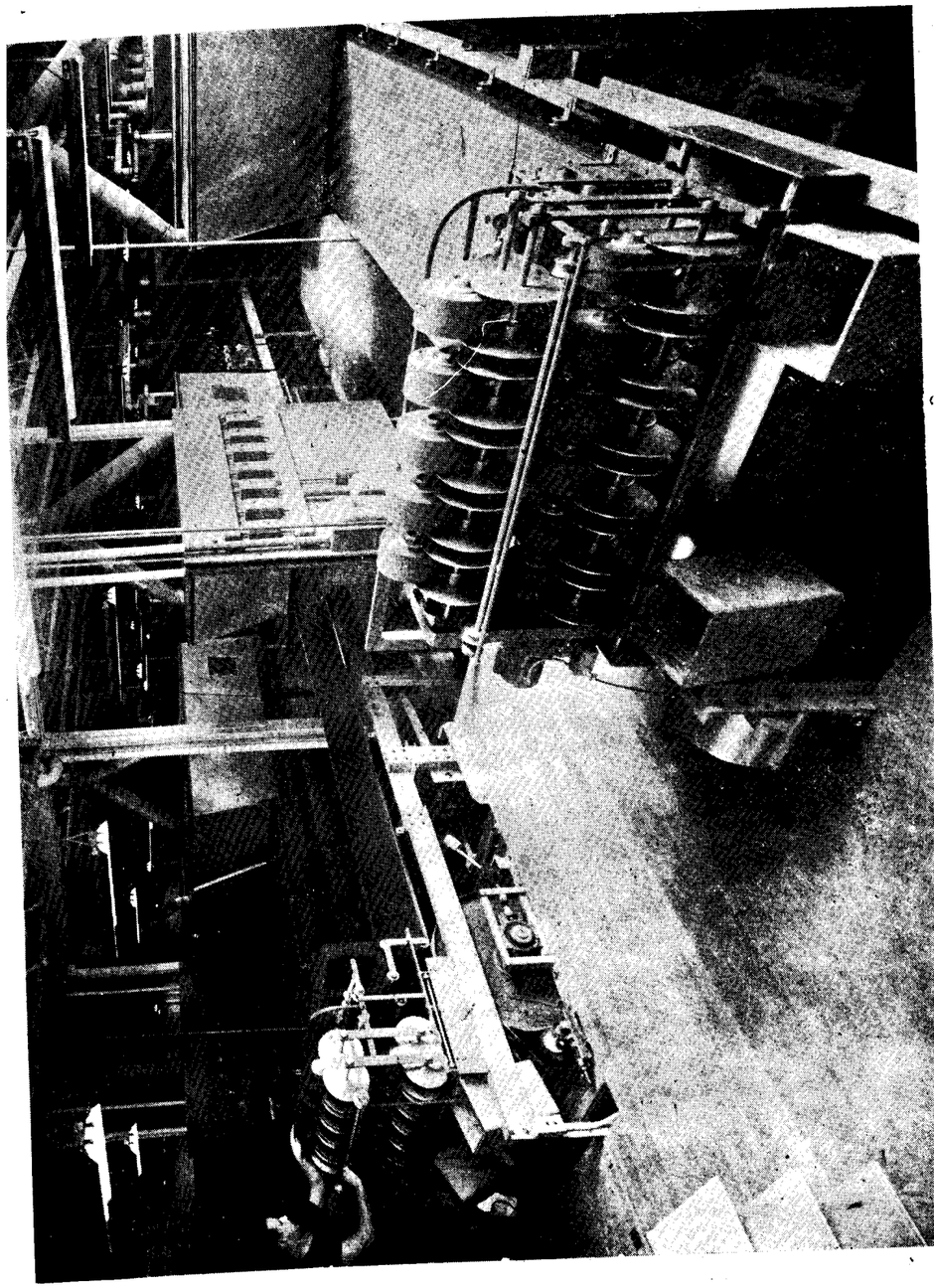


Fig. No. 1. The finished HTL. is slit continuously into narrow widths and wound up.

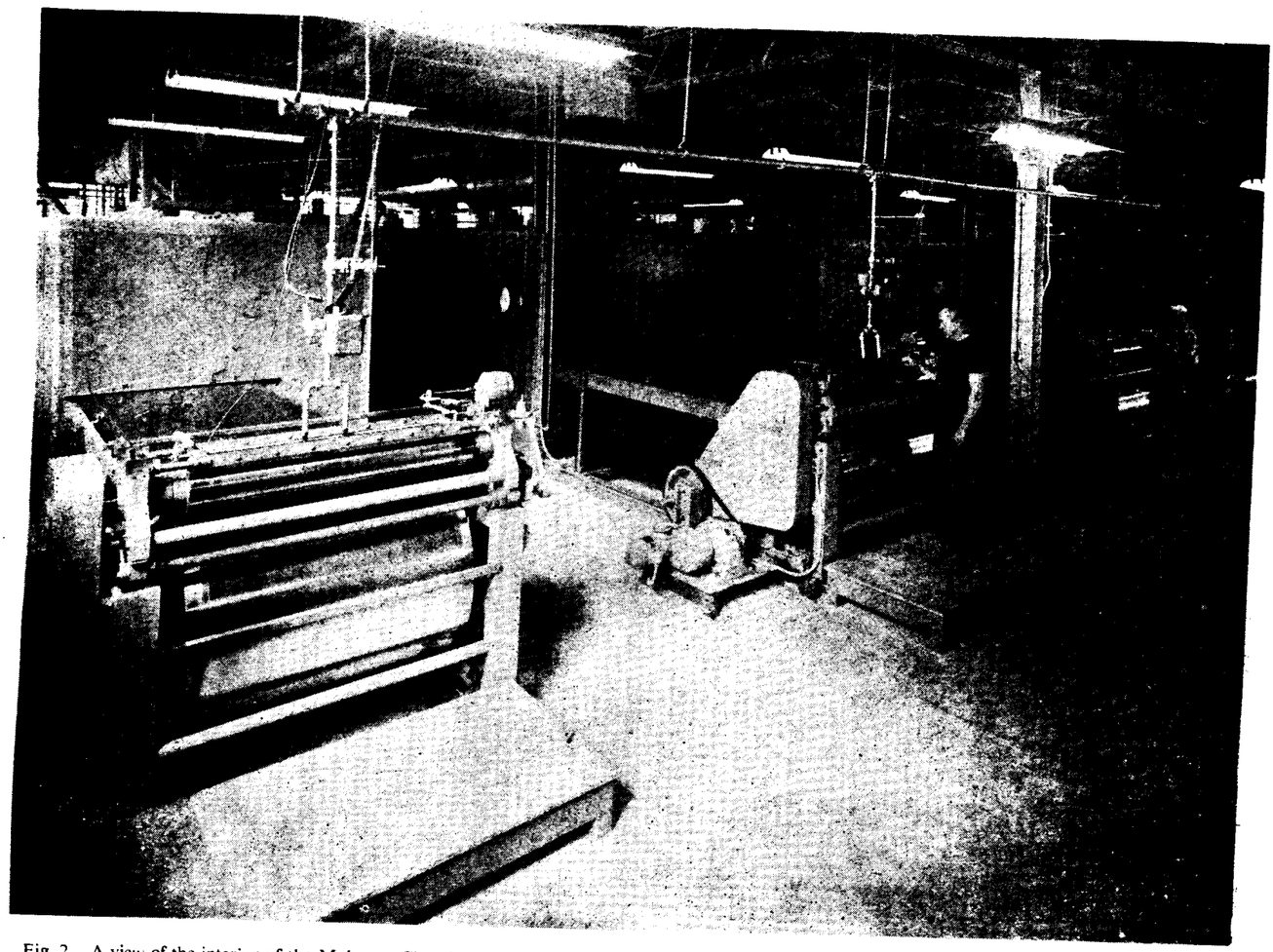


Fig. 2. A view of the interior of the Mahanoy City plant, showing several casting units on which the tobacco dough is formed into wide bands of HTL.

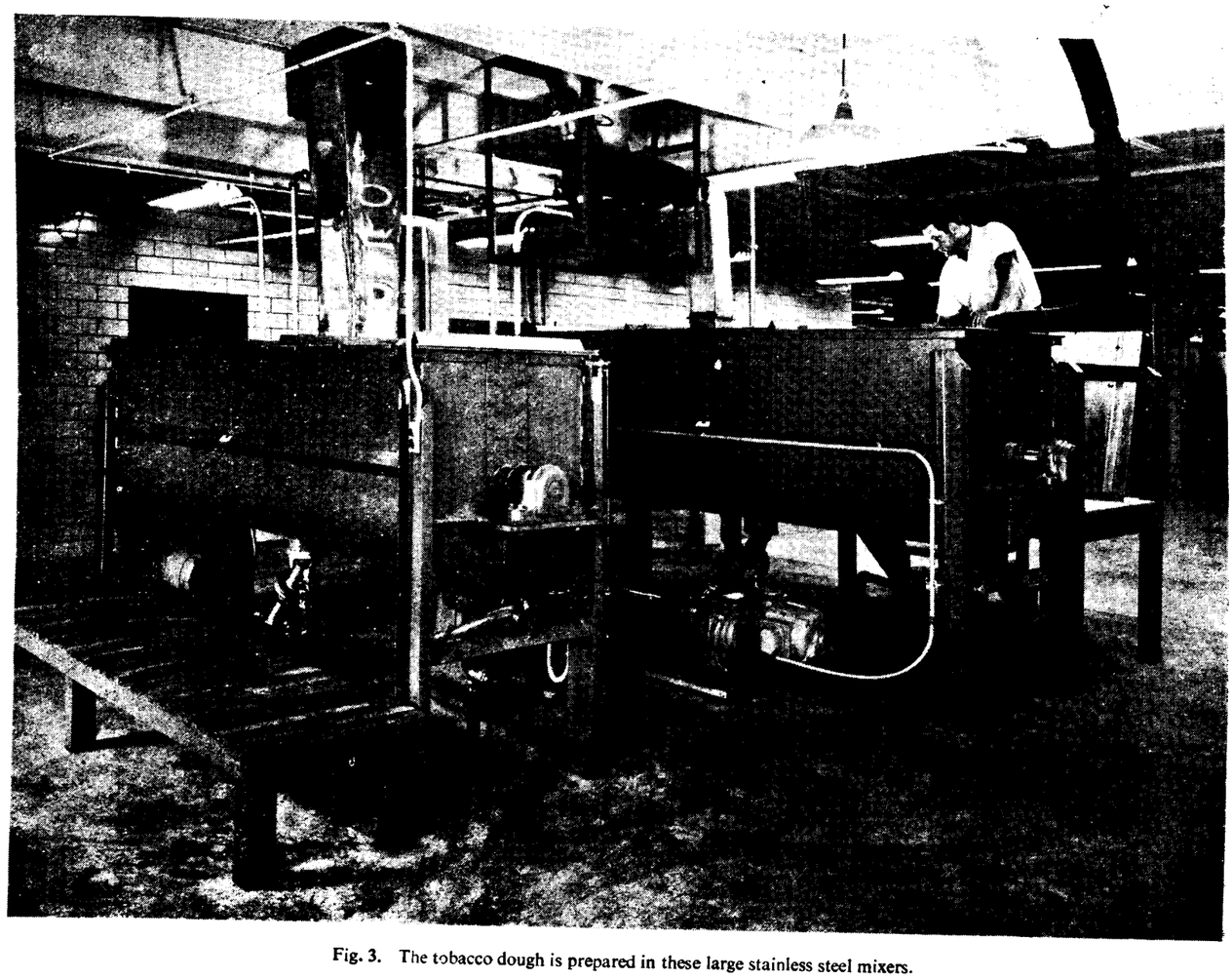


Fig. 3. The tobacco dough is prepared in these large stainless steel mixers.

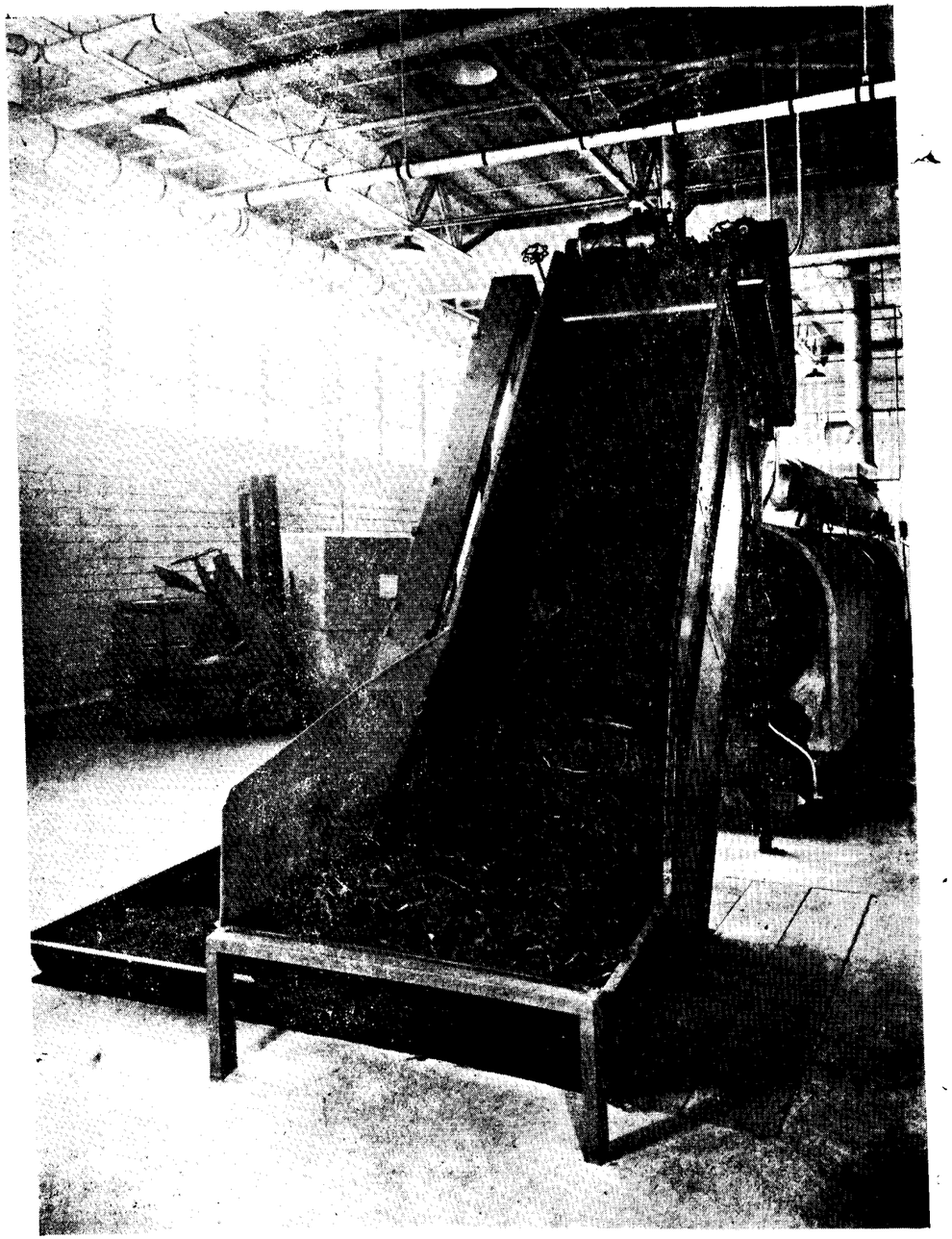


Fig. 4. The first step in HTL manufacture is the preparation of the tobacco flour. Here the tobacco is fed into the drying tunnel prior to being made into the flour.

Chemical Research on Tobacco of Vital Importance

" Although the idea of forming a continuous film from tobacco powder", the late Dr. Frankenburg has often said, " is not new, it is a startling fact that since the appearance of the first patents in this field, about 1850, no commercial acceptable material has ever been produced until now. Undoubtedly, our success in this field is due to our basic chemical investigations of the tobacco leaf. We have learned much of what may be responsible for good smoking quality in a tobacco leaf. Similarly, we also know what may be detrimental to smoking quality. This experience and knowledge are responsible for the high quality of HTL and its wide acceptance by the public and the cigar industry".

No Substances Foreign to Tobacco are used

Since the chemical investigations into the make up of the tobacco leaf had given Dr. Frankenburg and his associates certain basic information, they were able to select for the preparation of the tobacco dough those ingredients which are similar or identical to those naturally present in the leaf. Among the substances used are a cellulose compound, almost identical to the cellulose present in the leaf, a non-combustible burning catalyst which is responsible for the excellent burn and mildness of cigars containing HTL, and other ingredients, each selected to import to the HTL a specific desirable property.

The tobacco dough is allowed to age in cold rooms and then it is pumped to a casting machine where it is spread continuously on endless stainless steel belts. The tobacco dough, on the belt, is dried continuously, then coded and made pliable by passing through a spray chamber. As it emerges from the spray chamber, the HTL, now in wide bands, is slit to desired widths, determined by the size of the cigar on which it is to be used and wound up.

The Company's two HTL plants are producing in excess of four million pounds of this new tobacco product yearly. In length, the production amounts to approximately 190,000 miles of HTL every year, enough to go nearly eight times around the earth.

Except for the machinery which produces the tobacco flour, all of the equipment in an HTL plant is made of gleaming stainless steel. The appearance of the plant and its equipment remind the visitor of the cleanliness and appearance of a dairy or ice cream manufacturing plant.

HTL Offers Manufacturers Unforeseeable Benefits

HTL has an excellent burn, it forms a firm ash, and develops a very mild and aromatic smoke. It makes possible a uniformity of quality which otherwise is unattainable. HTL can be fed automatically into cigar machines and thus represents the first major step toward full mechanization of cigar production since the innovation of the cigar machine in U.S.A., thirty-nine years ago.

Prior to his death in July, 1957, the late Dr. Frankenburg was often asked to explain the success of HTL. " We succeeded in devising a special procedure for the preparation of ' Homogenized Tobacco Leaf ", he said, " that does not disturb the delicate balance of chemical substances contained in the tobacco particles, thus preserving their full natural aroma. Moreover, in selecting the ingredients of our patented HTL formula, we did not introduce a single element ' foreign ' to tobacco."

SEMINAR ON CONTROL OF GROUND BEETLES

A seminar on ' Laboratory and field studies on the various insecticides for the control of ground beetles attacking tobacco ' was held on 31st March, 1958. Dr. N. R. Bhat, the Director, Tobacco Research, presided. The main speaker was Mr. B. G. Joshi, Entomological Assistant of the Institute.

Initiating the discussion, Mr. Joshi referred to the laboratory and field experiments that were conducted on ground beetles at the Institute and briefly summarised the findings as follows :

Three species of ground beetles *viz.*, *Mesmorphus villiger*, *Scleron latipses* and *Opatroides frater* attack tobacco immediately after transplanting. The damage is either by cutting or gnawing of the stem. When the cut is deep the plants die and cause gaps. As the gap-filled plants do not grow as vigorously as the initially planted ones, there is reduction in yield.

Experiments were carried out in the Entomology laboratory to study the relative toxicity of different insecticides to ground beetles, and also to find out the most effective insecticide and the most economic method of its application in the field.

In the laboratory, Dieldrin, Aldrin, Endrine, D.D.T. and Lindane all in technical grades were tested. The beetles were treated with the insecticide dissolved in Acetone on the ventral side of the thorax by means of a hypodermic syringe. Five tests involving as many as 1764 beetles were carried out. Mortality observations were taken and L.D./50 values for various insecticides, 48 hours after the treatment were calculated. Lindane was most toxic, while Dieldrin, Aldrin, Endrine and D.D.T. were equally effective. Almost cent per cent mortality was obtained 96 hours after the treatment.

In the field, Dieldrin, Aldrin, Chlordane and Endrine in the form of wettable powders, emulsion concentrate and dust were tried. These were applied in three different ways, *viz.*, (1) mixed with fertiliser (2) in transplanting water (3) by both methods. Dead bettle counts were taken. Dieldrin was most toxic followed by chlordane, aldrin and endrine. The application in transplanting water was more effective than the application with the fertilizer, while the combination of both was most effective.

Supplementing, the Entomologist of the Institute, explained the criteria in the choice of insecticides and methods of application. On the economics of the insecticides he felt that Dieldrin, though costlier than Gammexane, gave better kill. If not, chlorodane which is as cheap as Gammexane could be used, as it may not leave bad effects on the leaf as gammexane. She was not happy about B.H.C. though it was cheap as an American worker had reported that it tainted the tobacco and also it had bad effect on the leaves.

In the discussions that followed, the speaker answered several questions relating to the selection and method of application of insecticides. The Assistant Tobacco Extension Officer who was also present, stated that cheapness was the main reason for farmer's use of B.H.C. and desired the Institute to recommend an insecticide costing not more than Rs. 6 to 7 per acre.

In his concluding remarks, the president emphasised the need to evolve techniques for determining the movement of beetles in the field and the exact count of their death due to insecticide and also to include two or three cheap insecticides in the trials. He said that as the work had started recently, it will take some time before a cheap as well as effective method of control of the pest could be suggested.

With a vote of thanks the seminar concluded.