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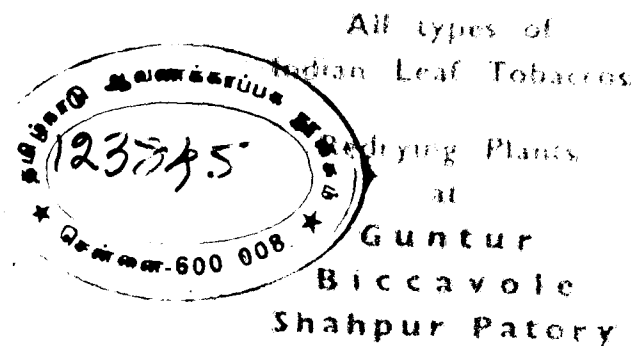
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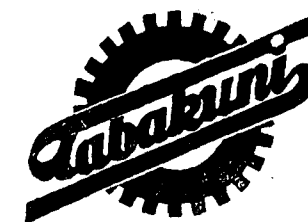
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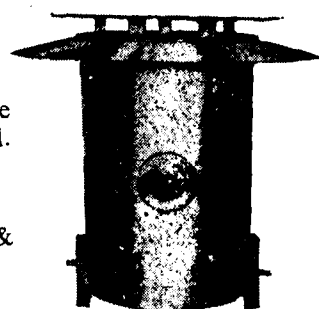
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SOME IMPROVEMENTS IN FLUE-CURING SCHEDULE

BY

N. L. PAL*

During the last curing season a comparative study was made of the flue-curing method generally followed by the farmers and the modified method adopted and being advocated by the Institute. The results of this study are discussed in this article for guidance of interested farmers and curers in improving their own curings and obtaining better returns from their labours.

Four comparative curings were undertaken during the period between 15th February 1957 and 10th March 1957 and therefore the primings in general consisted of leaves from the middle regions of the plants. In some instances leaves from the first primings and some from the late primings were also included but the quantities of such leaves were small. The material consisted of leaves harvested from different fields under various agronomic and other field experiments of the Institute and therefore was not homogeneous. But whatever the material, care was taken to distribute it equally between the two barns under study by dividing the leaves from every field into two equal portions and curing them in the two different barns loaded and run simultaneously, one by the farmers' method and the other by the modified method.

Before discussing the results of the comparisons, it is pertinent to point out that the barn in which the modified schedule of curing was followed had also a modified construction in respect of furnace and flues, and bottom and roof ventilators. The

comparisons were made in Barn II (Farmers' method) and Barn III (modified method) at the Kateru farm. Both the barns are of the size 16' × 16' × 16' high and are provided with 4 compartments of 4 tiers each and 3 tiers in addition in the gable. But they differ on the following points:—

1. *Furnace and flues:*—The furnaces in both the barns are identical but in Barn III the furnace is provided at the flue-pipe end with a masonry chamber of the size of about 5' × 10' from which two flue-pipes run along the middle of the barn at a distance of about 3½' from each other, instead of the usual single central flue-pipe in an ordinary barn. There are thus 4 flue-pipes in Barn III compared to only 3 in Barn II.

2. *Bottom ventilators:*—Barn II was run using the ordinary window type bottom ventilators about 2' × 1' each, ten in all in number. In Barn III the window type ventilators were not used, instead ventilation was provided through holes in the walls 90 in number, each 3" in diameter at the outside surface of the wall and tapering into horizontal slits 2½" × ½" at the inside. These holes are provided all along the walls at intervals of about 6" and are operated by a number of overlapping wooden shutters which are manipulated in grooves in frame works provided on the outer side of the wall.

3. *Top ventilators:*—In Barn III ventilation at the roof is provided by 4 window type

*Plant Physiologist, Central Tobacco Research Institute, Rajahmundry.

shutters, 2 on either side of the ridge of the roof. Each of these is 7' long and about 10" wide and is worked by means of a rope and pulley arrangement. These shutters can be operated more efficiently than the ordinary type of ventilators to control the humidity.

Characteristics of the modified schedule:— The modified method of curing differed from the farmers' method principally in the temperature and ventilation schedules as discussed below. It must be emphasised that no hard and fast schedule can be prescribed for flue-curing. The progress of the curing depends on many factors such as variety, maturity of the leaves, position of plants from which they are harvested, soil conditions under which the plants are grown, weather conditions at the time of curing, etc. Therefore, every curing must be followed individually and the operations adapted for

the most satisfactory results. The modified method herein followed lays emphasis mainly on two aspects, (1) to dry the leaves as far as possible during the yellowing stage without interfering with the yellowing process and (2) to minimise the time taken to dry the leaves in upper tiers by earlier increase in temperature in these tiers by reduction of ventilation.

A comparative account of the differences in operations in the farmers' method and the modified method are given below. The record of temperatures at the lower most (bottom) tiers and also at the fourth tiers are represented in the accompanying graph. (Fig. 1).

[Fig. 1 Temperatures recorded in the two barns at the bottom and fourth tiers (from comparison 4)]

Farmers' method

1. Yellowing stage :—

- (a) Following the usual practice of the farmers the fire was not started till about 21 hrs. after loading of the barns—the temperature during this period was between 80 and 88°F.
- (b) No ventilation was allowed till about 37 to 40 hrs. from loading. The top and bottom ventilators were slightly opened when the temperature was raised to about 105°.

Modified (Institute) method

- (a) Fire was started soon after the loading was over. The temperature was raised to a few degrees above the room temperature and from about 10 hrs. of loading was maintained at about 90°F (see Fig. 1).
- (b) The roof and bottom ventilators (holes) were slightly opened from almost the beginning. As yellowing progressed the openings were gradually increased. This reduced the moisture in the barn as yellowing progressed and therefore there was less moisture in the leaves at the fixing stage.

It should be emphasised that care must, however, be taken to see that sufficient moisture is retained in the barn for yellowing to proceed on and to see that the leaves do not dry too fast and get fixed on the green colour. If the humidity in the atmosphere is very low it may be necessary to keep the ventilators closed for a good portion of the yellowing stage.

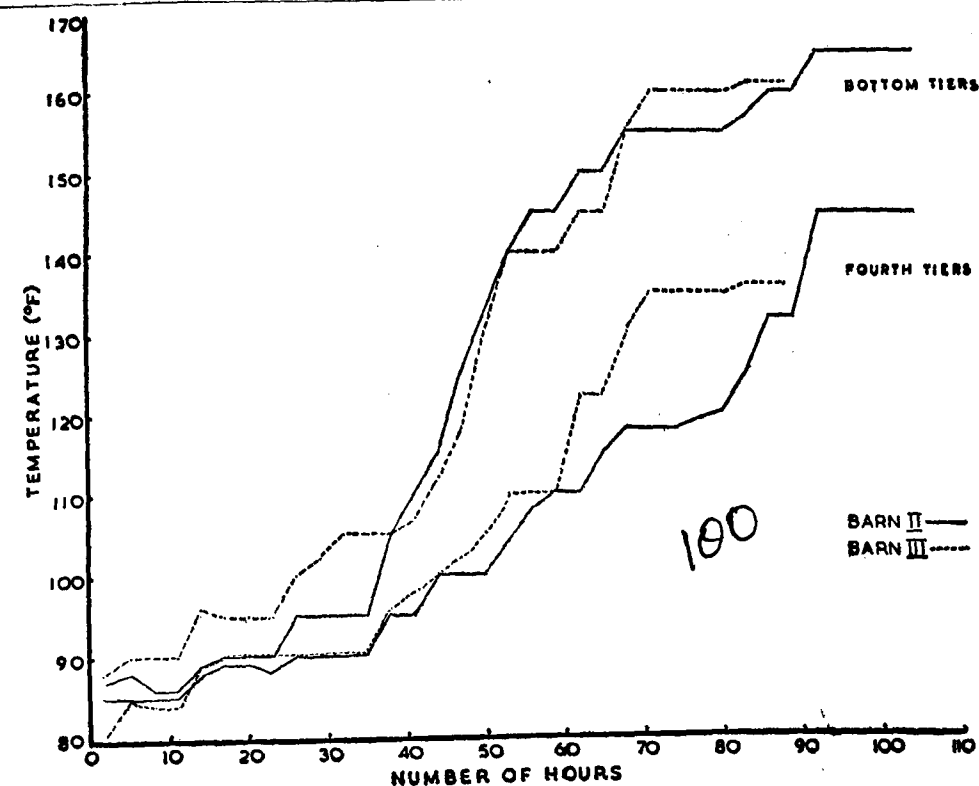


Fig. 1—Graph

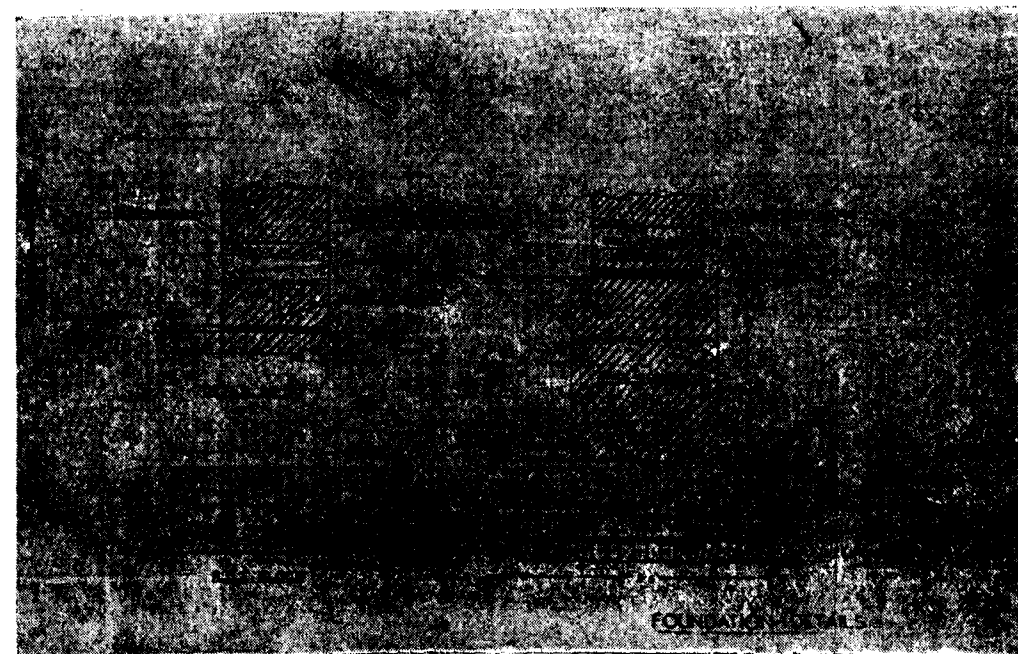
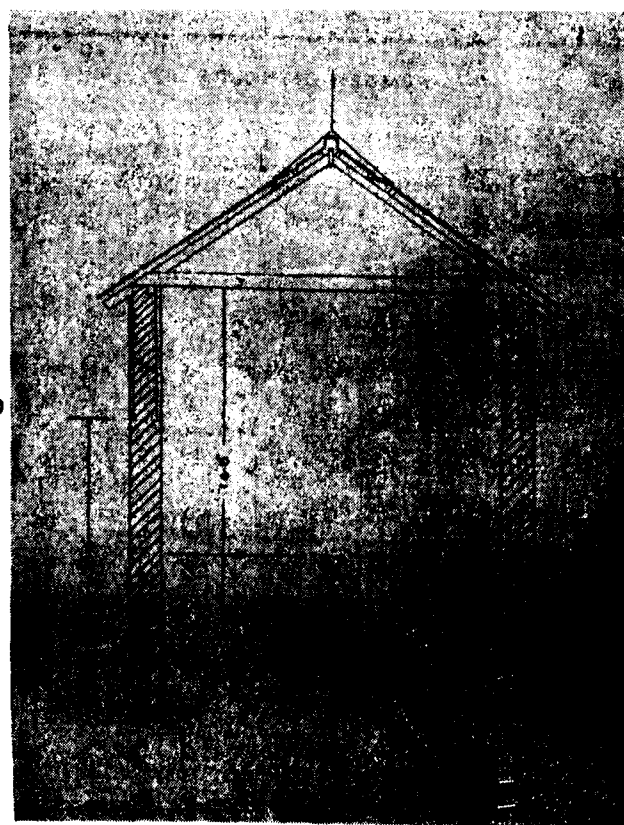
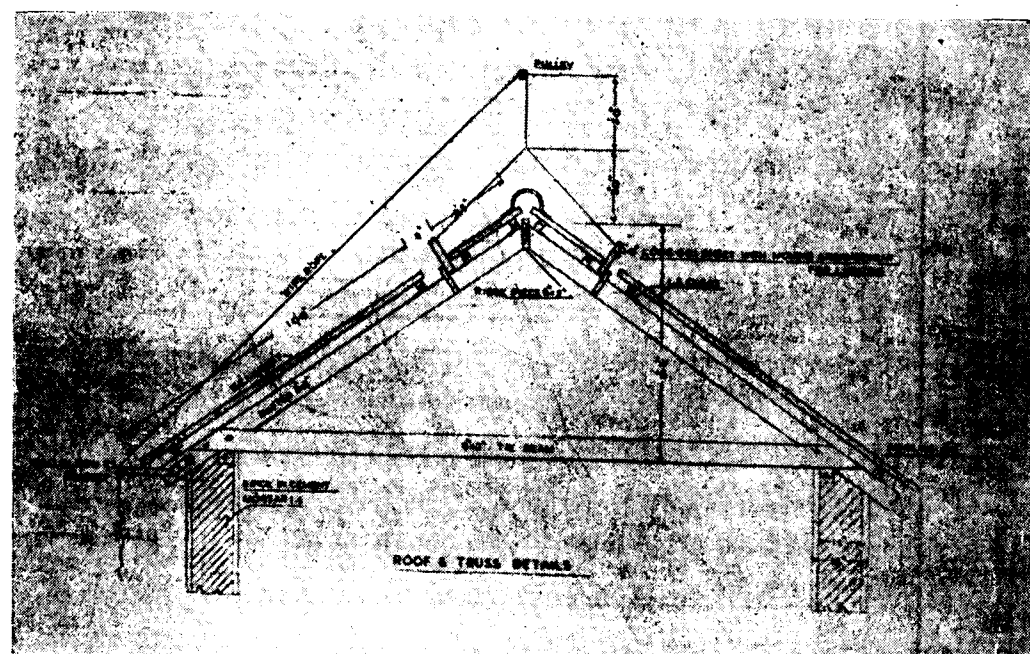


Fig. 2



2. Fixing Stage :—

- (a) The ventilation was further increased at the time of fixing of the colour. The farmers generally open the ventilators too wide. In these experiments, however, top ventilators were raised only by about 8" and bottom ventilator doors to about 6 to 7" at the maximum.
- (b) The temperature was raised from 105° to 125° in 4 to 5 stages in the course of about 4 to 5 hours.

3. Leaf drying stage :—

Ventilators were kept open until the lamina were fairly dry and then gradually reduced. Both top and bottom ventilators were finally closed between 78 to 88 hours when only the midrib was left to be dried.

- (a) The maximum ventilation given was an opening of about 5" to 6" in the top ventilators. The shutters of bottom holes were all fully opened during fixing.
- (b) The temperature was raised more slowly taking 7 to 10 hrs. to reach 125° level.

Ventilators were gradually begun to be closed from about the 50th hour and completely closed by about 70—74 hours. The early closing of the ventilators raised the temperature of the top tiers in comparison with that of the other barn (see Fig. 1). As a result the top tier leaves dried at a faster rate and therefore, the curing was completed earlier than in the other barn.

Some caution is necessary in following the procedure of closing the ventilators during the leaf drying stage. The idea behind earlier reduction in ventilation is to conserve coal by reducing escape of hot air and also to reduce the temperature difference and consequently the drying conditions between the bottom and the top tiers. In order that the drying conditions can be followed easily, it is necessary to install dry and wet bulb thermometers in the barn. The difference between the readings in the two thermometers is dependent on the humidity in the atmosphere. Therefore, if the ventilators are closed too early preventing the moisture to escape from the barn, the humidity will increase and so will the read-

ing in the wet bulb thermometer. Thus the difference between the dry bulb and wet bulb thermometer readings will be lessened. This will give an immediate indication that the ventilation is being reduced too fast. So long as the difference between the two thermometers continues to widen as the temperature is raised, it can be expected that the leaves will be drying without danger of sponging.

Results of the Comparisons

1. *Coal consumption*:—The data regarding the weights of leaves cured and fuel consumed are presented in Table 1. It will be noted that the weights of green leaf loaded and cured leaf obtained in the two methods of curing were similar in the two barns.

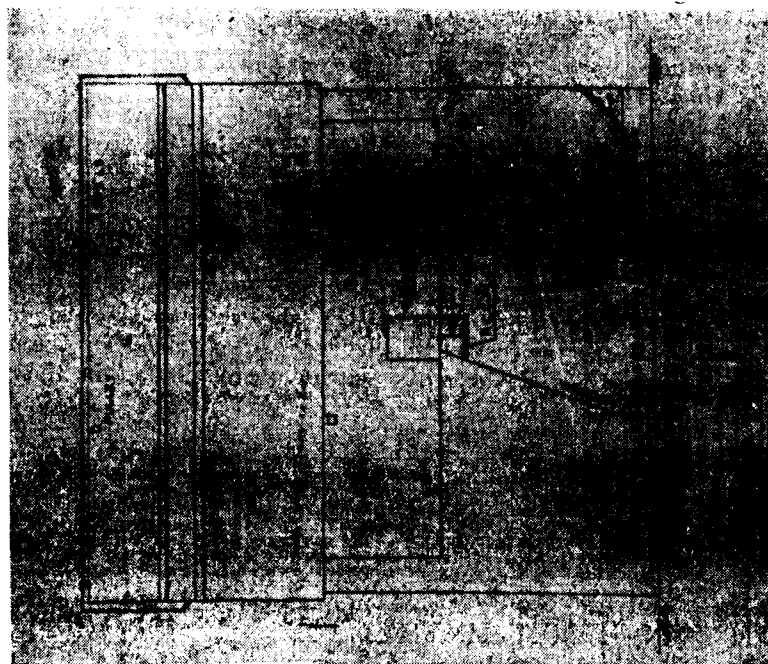
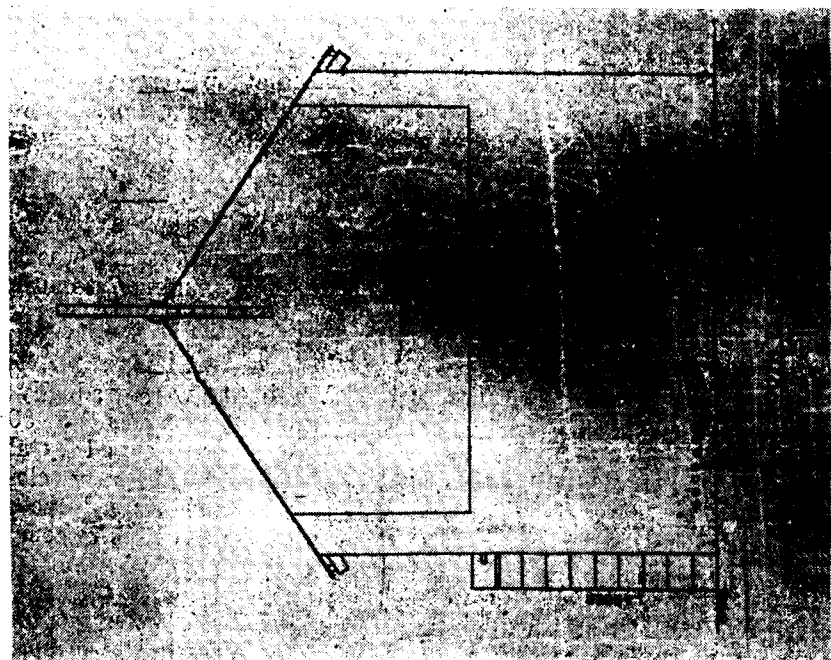


TABLE 1

Weights of tobacco cured and coal consumption

Date	Compa- rison	No. of sticks	Green wt. (kg.) loaded	Cured wt. (kg.) unloaded	Ratio cured wt. green wt.	Coal used (lbs.)	Coal (lbs.) 1 kg. green wt.	Coal (lbs.) 1 kg cured wt.	Hours required for curing	
Barn II (Farmers' method of curing)—										
15—2—	...	1	855	2,545	373	0.144	2,800	1.100	7.507	125
22—2—	...	2	761	1,945	364	0.187	2,140	1.100	5.879	111
28—2—	...	3	795	1,925	419	0.218	2,500	1.298	6.000	108
6—3—	...	4	837	1,551	373	0.240	2,150	1.386	5.764	104
	Total	...	3,248	7,966	1,529	0.789	9,590	4.884	25.150	448
	Mean	...	812.0	1,992	382	0.197	2,397	1.221	6.288*	112
Barn III (Modified method of curing)—										
15—2—	...	1	851	2,557	446	0.174	2,800	1.095	6.278	129
22—2—	...	2	754	1,938	345	0.178	1,867	0.963	5.412	100
28—2—	...	3	735	1,810	424	0.234	2,240	1.237	5.283	101
6—3—	...	4	844	1,478	322	0.218	1,530	1.035	4.752	88
	Total	...	3,184	7,782	1,537	0.804	8,437	4.330	21.725	418
	Mean	...	796.0	1,945	384	0.201	2,109	1.082	5.431*	104.5

* Difference statistically significant at 5% level.
C.D. = 0.642.

In order that the coal consumption can be studied properly, the calculated quantities of coal used per kilogram and the green weight and cured weight of tobacco are given in columns 8 and 9. Coal consumption is slightly higher in the farmers' method in all the four comparisons. On an average, coal consumed (a) per kg. green weight and (b) per kg. cured weight were 1.22 lb. and 6.29 lb. in farmers' method compared to 1.08 lb. and 5.43 lb. respectively in the modified schedule. A total of 1153 lbs. of coal (costing Rs. 24=00) is saved in the 4 charges. The advantage of curing by modified schedule is therefore Rs. 6=00 per charge on the cost of coal.

2. *Time taken in curing*:—Column 10 (Table 1) represents the time taken for the curings to be completed. On an average the curings by the modified methods were over 8 hours ahead of the curings by the farmers' method. The reduction in time is of special importance during the busy curing season and can be of considerable assistance in completing the curing programme in time.

3. *Quality of tobacco cured*:—The tobacco cured in each barn was graded separately to study the quality of the curings.

TABLE 2
Quality of Cured Tobacco

Date	Comparison	Weight of green leaves (kg.)	Weight of cured leaves (kg.)	Weight of bright grades (kg.)	Weight of bright grades per 1000 kg. green wt.	Weight of bright grades per 1000 kg. cured wt.	Total bright leaf equivalent (kg.)	T.B.L.E. per 1000 kg. green weight	T.B.L.E. per 1000 kg. cured weight
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Barn II—(Farmers' method of curing)									
15-2—	...	1	2,241	371	167	68.4	450.0	237	96.98
22-2—	...	2	1,348	276	112	82.9	404.3	158	117.25
28-2—	...	3	1,663	376	148	88.7	391.9	197	118.29
6-3—	...	4	621	129	35	56.9	273.6	60	97.32
Total	...		6,073	1,152	462	296.9	1,519.8	652	429.84
Mean	...		...	...	...	74.2	379.9	...	107.46*
Barn III—(Modified method of curing)									
15-2—	...	1	2,410	437	184	76.2	419.7	268	111.26
22-2—	...	2	1,302	261	119	91.2	455.1	160	122.78
28-2—	...	3	1,332	299	139	104.3	465.0	180	135.34
6-3—	...	4	616	130	37	60.0	284.1	65	105.28
Total	...		5,660	1,127	479	331.7	1,623.9	673	474.66
Mean	...		...	...	...	82.9	406	...	118.67*

* Difference significant at 5% level.
C.D. = 10.35

The weights of bright leaves obtained from different curings are indicated in column 5 and the calculated weights of such leaves per 1000 kg. green weight of leaves cured and per 1000 kg. of cured weight are given in columns 6 and 7. It is clear from those figures that the quantity of bright leaves both in actual weight and in relation to the weight of green or cured leaves is better in the modified schedule. For a direct comparison of the total produce the quantity of total bright leaf equivalent (weight of bright leaves plus the weight of middle grade leaves a factor in proportion to their price as to the price of the bright

grades) and the total bright leaf equivalent per 1000 kg. green weight and cured weight are worked out and represented in columns 8, 9 and 10. In all the four curings the total bright leaf equivalent per 1000 kg. green weight of leaves or per 1000 kg. cured weight (except in one case) is better in the barn run on the modified schedule. Calculated on equal green leaf weight basis (673×6073) 722 kg. of Total Bright Leaf Equivalent are obtained from barn III compared to only 652 kg. obtained from barn II. The extra price realised at Rs. 1.37 per lb. (present average rate for bright tobacco)

works out to Rs. 211.75 in 4 charges or Rs. 58.44 per charge.

The advantage in favour of curing by the modified method (Institute method) therefore sums up to Rs. 64.44 (Rs. 58.44 from better quality and Rs. 6.00 from savings on fuel) and also 8 hours of curing time in each charge.

It was mentioned earlier that the modified (Institute) method of curing was done in a barn which had certain constructional differences. It may be argued that the advantages mentioned above may be due to this factor.

Although a small advantage might have resulted from the constructional differences the greater part of the benefit really accrued from the modification in the schedule of curing. The changes in the barn construction only helped in better control over the operations to follow the schedule such as maintenance of temperature and humidity

at the desired levels. If the modifications of the curing schedule are followed considerable improvement would be expected in farmers' curings even with the existing barns without any alterations in them. However, the system of top ventilation can be changed within a small cost and it would be worthwhile investing a few rupees on replacement of the existing top covers with the window type of ventilators. Installation of a dry and wet bulb thermometer is also of utmost importance. If these two things are adopted it will be possible to follow the schedule with ease and confidence.

My thanks are due to Shri Ananda Rao, Curer, and Shri T. G. Shahani, Farm Manager, for supervising the curings and to the head of different sections for supplying me the grading data. I am also thankful to Dr. N. R. Bhat, Director, Tobacco Research for the facilities provided for this study and for his interest in going through this paper.

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4. Agricultural Botany
5. Agricultural Zoology (including Fisheries),
6. Horticulture
7. Animal Breeding
8. Animal Nutrition (including Physiology and Biochemistry),
9. Animal Diseases
10. Dairying, and
11. Agricultural & Animal Husbandry Economics and Statistics.

2. These prizes will be in the form of gold medals or cash or both and the first prize in each subject will be awarded for outstanding research work done in the country either individually or jointly, during the calendar year 1957, i.e., 1st January to 31st December, 1957, and thereafter for such research work carried out during each subsequent calendar year.

3. The award of each of the prizes shall be based on significant advances in human knowledge in a particular subject as revealed by books, monographs or papers published in the name of the candidate or any other unpublished account of the outstanding research work done or discoveries and inventions made by him. The selection of a candidate for the award of a prize will be made on the recommendations of a Judging Committee consisting of eminent scientists appointed for the purpose by the Indian Council of Agricultural Research. The award of a prize may be made to more than one research worker and the prize money divided amongst them in such proportion and manner as may be decided by the Council.

4. All research workers, engaged in research work in India, in the fields of agriculture, animal husbandry and allied sciences are eligible for competing for these prizes. Applications should be submitted in **quintuplicate**, in the prescribed form, which can be had, free of cost, from the Additional Secretary, Indian Council of Agricultural Research, Queen Victoria Road, New Delhi. Candidates working in Research Institutes etc., should submit their applications through the Head of the Institute/Department etc. Others may submit their applications direct.

5. All applications should be sent in a sealed cover and addressed to the Additional Secretary, Indian Council of Agricultural Research, Queen Victoria Road, New Delhi, so as to reach him not later than the 30th April, 1958. The cover of applications should be superscribed as under :

"Application for the award of 'The Rafi Ahmed Kidwai Memorial Prize for Research' in....."

Applications received after the 30th April, 1958, will not be considered.

SUPPRESSION OF SUCKERS IN CIGAR TOBACCO BY VEGETABLE OILS AND EMULSIONS

BY

C. K. RAMAKRISHNA KURUP, A. S. SASTRY,
M. VENKATESWARAN AND K. V. VENKATARAMAN

(Cigar and Cheroot Tobacco Research Station, Veda sandur)

It is the general practice to top the cigar tobacco plant at 8 to 14 leaves and remove the suckers about two times. This is widely held to improve the yield and quality of the leaf. At present the suckers are removed by hand. This is an expensive and tedious process, and a simple and cheap method to control the suckers is much in demand.

The works of Pal and Kadam (1949, 1954) with flue-cured tobacco showed that the suckers could be effectively controlled by the application of mineral and vegetable oils, particularly coconut oil, to the top six leaf axils. The applicability of these findings to the cigar tobacco is doubtful as this is a more vigorous plant grown, with about ten times as much nitrogen as the flue-cured type. The experiments described in this paper were undertaken to clarify this point.

Materials and Methods

The variety used was a local cigar variety known as *vellavazhai*. The field received a basal dose of farmyard manure at 20 cart-loads per acre and ammonium sulphate at the rate of 50 lbs. nitrogen per acre. The seedlings were transplanted on ridges at a spacing of 2' between plants and 2½' between ridges. The crop received the usual cultural

operations of weeding and mummatti digging, 3 and 6 weeks after transplanting respectively.

Preliminary trials using mineral oils (kerosene and Diesel oil) showed that they scorched and burnt the leaves and stem, where applied. Hence they have been omitted in this study.

Experiment I was a preliminary study and was laid out in a simple randomised block design with six replications. Six plants were taken for each treatment. The treatments are given in Table 1. The oil emulsions were of 25% concentration by volume and were prepared by the method of Morrow and Sandstorm (1935). The gum concentration was the same as in the emulsions. All plants were topped at 14 leaves. The oils and emulsions were applied immediately after topping to the topmost four leaf-axils by means of a camel hair brush. Care was taken to see that no oil or emulsion trickled down the stem during application. From all treatments except control unsuckered the suckers were removed twice, 10 days after topping and before harvest. In all treatments the suckers produced from the four treated leaf-axils were weighed

performance was usually satisfactory at the beginning, but was not kept up later on, and therefore, there was need for confirmation. He felt that even Virginia Gold might be considered a good variety. Dr. Bhat disagreed and said that though the performance of Virginia Gold was of a high order from the point of bright leaf at the Institute's farm and even in Southern Rhodesia where it topped the list of varieties under trial in respect of yield as well as grade-index, it was not liked in the British market, where according to his information narrow leaved varieties were preferred for quality. Delcrest being of the latter type, was in good demand, and for that reason it occupied 20 per cent of the total area under flue-cured tobacco in Southern Rhodesia. For the above reasons, if the variety kept up its performance in future trials, it should prove a good substitute for Harrison Special in our country.

Shri A. S. Sastry, Chemist, pointed out that topping in different varieties had to be done leaving the same number of leaves on the plant to get a correct comparison of their performances. Dr. Bhat replied, that

the topping had been done as it should be done by the farmer in cultivating the varieties and comparison was made from a practical point of view.

Concluding the discussion Dr. Patel said, that though so far we had been attaching a good deal of importance to the grades for colour a gradual shift was being observed towards utilisation of other grades for other factors of quality as well. Development in the manufacture of filter-tipped cigarettes in a greater proportion in the world and the public preference has a definite bearing on use of tobacco. This trend deserved to be watched in further breeding work.

He expressed satisfaction at the useful way in which seminars were conducted and proposed to give a list of persons who were main speakers in seminars, in the Indian Tobacco by way of encouragement and stated that a catalogue giving details of various varieties tried, their performances etc., if prepared, will give valuable data.

With a vote of thanks by the Secretary of the Seminar Group, the seminar concluded.

Expert Committee on Tobacco

(Continued from page 269)

5. The Committee was, by a separate reference from the Central Board of Revenue requested to examine the question of losses occurring in tobacco under bond and to advise Government on this matter. The Committee has recommended that experimental data to ascertain the normal degree of losses should be collected in a fuller and more uniform way and that all factors contributing to the loss should be given due weight while deciding loss cases.

6. Government have accepted the Committees' recommendation regarding of classification of non-flue-cured unmanufactured tobacco for purposes of assessment and have implemented it in the Finance (No. 2) Bill, 1957.

7. Government have also generally accepted all the Committees' recommendations for improving control over growing and curing of tobacco. Augmentation of staff will, however, be considered in the light of Governments' efforts to rationalise the administrative machinery by setting up MULTIPLE OFFICER RANGES which is in hand and which aims at reduction of clerical and unproductive work of the field staff.

8. Government have also generally accepted the Committees' other recommendations but have reserved their decision on the question of dealing with losses occurring in bond till they have had time to collect more data and to examine the matter more fully.

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PRELIMINARY STUDIES IN THE CONTROL OF SUCKERS IN TOBACCO BY THE USE OF CHEMICALS*

BY

A. S. SASTRY,¹ C. K. RAMAKRISHNA KURUP² AND
M. VENKATESWARAN³

(Cigar and Cheroot Tobacco Research Station, Veda sandur)

Soon after topping, the tobacco plant develops axillary branches or suckers. Removal of these at periodic intervals is necessary for the improvement of the quality of the leaf and also its yield under favourable conditions. As practised at present the suckers are removed by hand. This is a laborious and expensive process as the fields have to be visited a number of times. Also frequent visits to the field may cause physical damage to the leaf. A simple and inexpensive method for suppression of suckers is much in demand by the farmers.

The discovery by Thimman and Skoog (1933; 1934) that hormones govern the growth of buds, and the recent researches covering hormone like action of many organic chemicals (Hitchcock 1935; Zimmerman et al, 1942) point to the possibility of using chemicals for this purpose.

Using the tobacco plant, Pal and Kadam (1951) reported that application of indole butyric acid, indole acetic acid and 2, 4—dichlorophenoxy acetic acid at concentrations of 0.01 to 0.5% to the cut end after topping were ineffective. Calvert (1953) found similar results using them as pastes.

The results of Steinberg (1950) however are more encouraging. During the course of greenhouse tests, he found that indole butyric acid, naphthalene acetic acid and their methyl esters applied to the cut end either as such or through carriers were quite effective. However the results of greenhouse tests can neither hold quantitatively in the field nor are they useful in studies of quality of cured leaf. Further, chemicals found useful in a particular variety need not necessarily be so in another.

* This paper was read at the First Conference of the Tobacco Research Workers in India, held at Bangalore on 31-1-1957 and 1-2-1957.

¹Chemist (Rajahmundry) ²Chemical Assistant (Rajahmundry) ³Junior Scientific Assistant (Veda sandur)

Experiments under field conditions using the requisite variety are therefore called for. The results reported in the present paper are purely preliminary in nature and refer to data obtained during one year using naphthalene acetic acid (NAA) and indole butyric acid (IBA) in different carriers and concentrations. Further experimentation to study the effect of different seasons and economic concentrations are underway and will be reported in subsequent papers.

Materials and Methods

The variety used was a local chewing variety known as valmonnai. A chewing variety has been chosen initially as, due to lower topping, sucker growth in this type is more vigorous than in the cigar types. The field was fertilised with 20 cartloads of farmyard manure one month before transplanting and 100 lbs. nitrogen half as ammonium sulphate and half as groundnut cake at the time of transplanting. Eight week old seedlings were transplanted on ridges on 18-11-1955. The spacing was 2½' between ridges and 2' between plants. The crop received the usual cultural operations of weeding after 3 weeks and mummatti digging after 6 weeks.

The experiment was laid out in a split plot design with the two topping levels (8 leaf and 12 leaf) as main treatments, and application of chemicals as sub-treatments. Topping was done on 23-1-1956 for 8 leaf and 30-1-1956 for 12 leaf levels. Six plants in each ultimate plot were treated with chemicals and replicated six times. The sub-treatments are indicated in column 2 of Table 1.

The powders were pressed into the cut stem immediately after topping, while lanolin salves were spread uniformly as thin films. In the case of triethanolamine solutions one drop per plant was spread on the stem with the finger. Coconut oil was applied to the top four leaf axils after topping.

Except in the case of control suckered, the suckers were removed at the time of harvest, and the total weight of suckers and number of suckers above 2" were determined. In the case of control suckered, two suckers at approximately 10 day intervals and one at harvest were carried out.

The plants were harvested on 20-2-1956 for 8 and 28-2-1956 for 12 leaf topping, sun-dried and fermented in bulks with leaves attached for about 25 days. The leaves were then separated from the stalks, all good leaves classified as good grade and all damaged leaves as *kruz* grade and then weighed. This furnished the yield figures.

The stripped leaves were again fermented in bulks for more than a month and quality characteristics like body, weight per unit area and hygroscopicity were determined for the promising treatments.

For these determinations the leaves of all the replicates of the promising sub-treatments were thoroughly mixed and 25 leaves of approximately the same length were collected at random. They were moistened and wrapped in a wet gunny overnight to bring them to condition. Their length and breadth were measured, the midribs removed and the oven-dry weights of lamina and midrib were determined. Two-thirds the product of length and breadth furnished the area, and weight of whole leaf or lamina divided by area gave the weight per unit area. The dry weight of 100 leaves was taken as a measure of the body.

The lamina and midribs were mixed, powdered and the hygroscopicity was estimated by determining the amount of moisture absorbed by 2 grams of oven-dry powder kept in a saturated atmosphere at room temperature (31°C) for 4 hours. The results were expressed on 100 grams oven-dry leaf.

Results

The number and green weight of suckers from six treated plants are presented in Table 1.

TABLE 1
Number and Green weight of suckers from 6 plants

S. No.	Treatment	No. of suckers	Green weight of suckers in grams	% suppression over control
Main treatments :—				
A	Topping at 8 leaves	24.32	1,332.88	.....
B	Topping at 12 leaves	24.22	1,010.60	.....
	C.D. at 5%	Not significant	Not significant	.....
Sub-treatments :—				
1.	Control—unsuckered	23.08	1,887.83	0.00
2.	Control—suckered	55.75	363.42	80.74
3.	Coconut oil	26.42	1,293.75	31.46
4.	Naphthalene acetic acid	21.67	911.50	51.71
5.	Indole butyric acid	23.75	1,299.92	31.14
6.	Triethanolamine	21.00	1,730.75	8.32
7.	2% NAA in lanolin	24.08	1,615.67	14.41
8.	2% IBA in lanolin	20.42	1,733.42	8.18
9.	20% NAA in triethanolamine	14.17	539.5	71.42
10.	20% IVA in triethanolamine	12.33	341.67	81.9
	S.E. as % general mean	33.33	39.23	...
	C.D. at 5%	6.57	373.38	...

Significance :—

I. Green weight of suckers.—

10 2 9 4 3 5 7 6 8 1

II. Number of suckers.—

10 9 8 6 4 1 5 7 3 2

As the trends were the same in both the topping levels the averages for the two toppings are shown.

The number of suckers is a rough measure of the amount of labour involved in removing them. On this basis treatment 2 (control suckered) was the worst, the number of suckers produced in this being more than double those in others. Treatments 9 and 10, produced the least number of suckers.

On the basis of green weight of suckers, the lower topping tended to produce greater weight of suckers, though statistically not significant.

Treatments 9 and 10 produced about the same weight of suckers as control suckered and taking the weight of suckers in unsuckered control for comparison, they suppressed

70 to 80% of the suckers which is similar to manual suckering.

Thus on the basis of both the number and weight of suckers produced, treatments 9 and 10 were undoubtedly the best.

It is of interest to see how these treatments affect the yield of leaves. The yield data are presented in Table 2.

TABLE 2
Yield of cured leaves, good grade leaves, and percentage of good grade leaves

S. No.	Treatment	Yield of cured leaf in lbs./acre	Yield of good grade leaves in lbs./acre	% good grade leaves
<i>Main treatments :—</i>				
A.	Topping at 8 leaves	1,626	1,365	83.94
B.	Topping at 12 leaves	2,309	1,873	81.11
	C.D. at 5%	227.98	219.58	...
<i>Sub-treatments :—</i>				
1.	Control—unsuckered	1,771	1,423	80.35
2.	Control suckered	2,047	1,670	81.58
3.	Coconut oil	2,105	1,757	83.46
4.	Naphthalene acetic acid	1,931	1,568	81.20
5.	Indole butyric acid	2,120	1,786	84.24
6.	Triethanolamine	1,873	1,554	82.96
7.	2% NAA in lanolin	2,047	1,699	82.99
8.	2% IBA in lanolin	1,859	1,568	84.34
9.	20% NAA in triethanolamine	2,047	1,699	82.99
10.	20% IBA in triethanolamine	1,859	1,510	81.22
	S.E. % general mean	12.28	14.11	...
	C.D. at 5%	197.03	186.47	...

Significances :—

I. Weight of cured leaves.—

5 3 2 7 9 4 6 8 10 1

II. Weight of good grade leaves.—

5 3 7 9 2 4 8 6 10 1

The higher topping significantly increased both the total yield and yield of good grade leaf.

As regards the sub-treatments manual suckering produced significant increases in the yield of leaves over control unsuckered. This was found to be particularly so in the higher topping.

On the basis of yield of cured leaves, treatments 9 and 10 were on par with treatment 2, while on the basis of good grade

leaves treatment 10 was on par with treatment 2 but was significantly inferior to treatment 9.

From the foregoing, it appears that treatments 9 and 10 were desirable from every point of view, and more so treatment 9. However, within 24 hours of application of these chemicals as triethanolamine solutions, the top three to four leaves curved backwards as shown in figure 1. No such effects were visible when triethanolamine was applied alone.



Top left - 20% IBA in Triethanolamine
Top right - 20% NAA in Triethanolamine
Bottom left - Triethanolamine
Bottom right - Control

The leaves however recovered and almost became normal within a week. It was feared that these leaves might be damaged due to dipping in irrigation water and thus reduce

the percentage of good grade leaves. However the last column in Table 2 shows that no such thing has happened.

These results indicate that it is possible to control suckers by applying naphthalene acetic acid and indole butyric acid as 20% triethanolamine solutions. The yield figures of cured and good grade leaves also suggest that these have not been adversely affected

by these treatments. It is necessary to see if the quality of the leaf is affected. The quality characteristics required for chewing tobacco are its body, thickness and hygroscopicity. Leaves with good body, thickness and hygroscopicity are preferred. These figures for treatments 9 and 10 which are the promising ones and treatment 2 which is the normal method of suckering are presented in Table 3.

TABLE 3
Effect of chemicals on quality characteristics in chewing tobacco

Topping	Treatment	Dry weight of 100 leaves in grams	Dry weight per square meter in grams (whole leaf)	Dry weight per square meter in grams (Lamina only)	Hygroscopicity (water absorbed by 100 grams dry leaf)
8 leaf ...	2	1,107.2	103.28	77.72	22.78
	9	1,157.2	100.10	76.51	23.97
	10	1,045.6	97.90	75.36	23.05
12 leaf ...	2	868.4	90.08	68.01	21.47
	9	862.4	90.97	69.45	21.95
	10	800.0	88.11	66.43	22.66

The data in Table 3 need a little explanation. The weight of 100 leaves roughly represents the body of the leaves. The weight per unit area is an approximate measure of their thickness. The hygroscopicity gives an indication of the ability of these leaves to absorb flavourings. On the basis of these data the leaves of treatment 9 are in no way inferior to those of treatment 2 which is the normal method. However there is an indication that treatment 10 (20% indole butyric acid in triethanolamine) slightly reduces the body and thickness of the leaf. The data also show that the body and the thickness of the leaves are reduced by higher topping, which is in agreement with the findings of other workers (Avery, 1934; Garner et al, 1934).

Discussion

The results clearly show that manual suckering significantly increased the yield of cured leaf thus pointing to the necessity of suckering. Presumably this is due to the elimination of plant organs competing with the leaves for the available nutrients. Suppression of suckers by chemicals also resulted in increases of yield over the unsuckered control in most cases. However

the increases in yield are not always proportionate to the amount of suppression of suckers. As may be seen from the following discussion other stimulatory and inhibitory factors are also probably at work.

Naphthalene acetic acid applied as 2% lanolin salve did not suppress the suckers significantly when compared with the unsuckered control. However there was a significant increase in leaf yield, which shows that the compound has stimulating action at this level. Further suppression of suckers by this compound as dry powder and 20% triethanolamine solution, did not change the leaf growth significantly, the increase in yield due to suppression of suckers being balanced by the inhibitory action of the chemical which may be a effect either of the carrier or of the concentration.

In the case of indole butyric acid, there was neither suppression of suckers nor increase in leaf yield when this compound was applied as 2% lanolin salve. However when this compound was applied as dry powder, there was a moderate suppression of suckers followed by a significant increase in yield. Further suppression of suckers when applied as 20% triethanolamine solu-

tion was associated with a significant decrease in yield which shows a definite inhibitory action. Thus depending on the form, concentration and carrier the chemicals appear to have stimulatory or inhibitory actions.

Thimman and Skoog (1933; 1934) and several others showed that the auxins produced by the terminal bud inhibit the growth of axillary buds. The chemicals applied to the cut stem after topping presumably act in a similar way. Pal and Kadam ((1951) demonstrated that indole butyric acid and naphthalene acetic acid applied at 0.5% concentration to the cut end after topping either as liquid or paste had little effect on sucker growth. However when applied directly to the axillary buds, they suppressed 60% to 70% of the suckers. These results suggest that the chemicals, to be effective, must be in such a form that they can travel through the stem and be present at the leaf axils in sufficient strength. This condition appears to be fulfilled in the case of dry powders presumably due to their solution in atmospheric moisture and 20% triethanolamine solution. Two per cent lanolin salves were not effective probably because they were not quite soluble in lanolin and also due to the low concentration in which they were applied. This finding is not in conformity with that of Steinberg (1950) who under greenhouse conditions found that these chemicals were equally effective as lanolin salves, dry powders and solutions of triethanolamine. Under field conditions, where higher illumination and less moisture obtain, higher concentrations seem to be required.

From the practical utility point of view the suppression of suckers achieved by the dry powders is not adequate. The only treatments which produced enough inhibition of suckers to be of practical value are 20% solutions of triethanolamine. In these treatments only a few suckers emerged by the time the crop was ready for harvest and these could be removed at harvest itself thus saving the trouble of the two previous suckering.

Of the triethanolamine solutions 20% naphthalene acetic acid appears to be superior to 20% indole butyric acid. In the former the yield of good grade leaf was on par with the manual suckering while in the latter it was significantly inferior to manual suckering. From the point of view of the quality characteristics of the leaf like body and thickness also, this treatment was as good as manual suckering, while 20% indole butyric acid showed a tendency to lower the body and thickness.

Summary

Preliminary experiments, conducted with a chewing variety of tobacco, showed that the suckers could be successfully controlled by applying naphthalene acetic acid and indole butyric acid to the cut stem after topping. The two most promising treatments were 20% solutions of these chemicals in triethanolamine. Of the two, 20% naphthalene acetic acid appeared to be more desirable from the point of view of yield and quality characteristics like body and thickness.

Acknowledgment

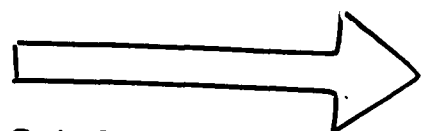
The authors desire to express their grateful thanks to Dr N. R. Bhat, Director, Tobacco Research, Central Tobacco Research Institute, for his helpful suggestions.

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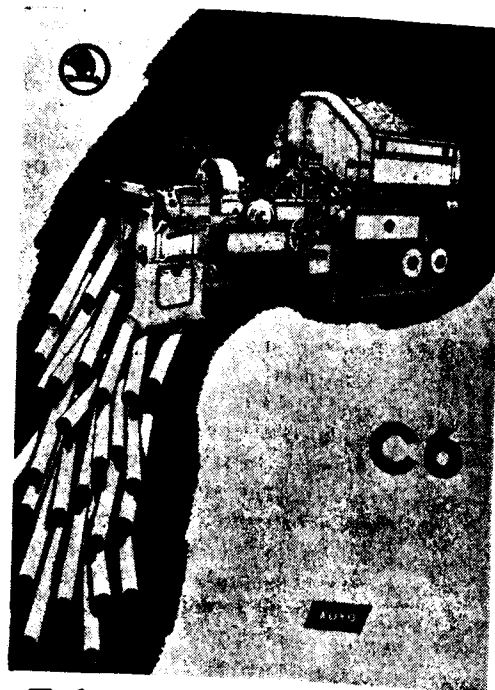
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CHITRI DISEASE OF TOBACCO IN GUJARAT I* NATURE OF DISEASE

BY

N. PRASAD,¹ I. M. PATEL² AND H. M. SHAH³

"Chitri" is a local name given to a disease of *bidi* tobacco in which individual as well as a number of plants is affected in a patch. The affected plants start wilting gradually and ultimately result in complete mortality of plants. The disease appears by the middle of October and the highest incidence of the disease is recorded by the middle of November. Buler (1918) who was first to record the disease, considered it similar to Granville wilt but to be caused by a *Fusarium*. Later Uppal, Patel and Kamat (1934) considered it to be due to *Fusarium oxysporum* var. *nicotianae* Johns. Mathrani, Elias and Kadam (1951) isolated a large number of *Fusaria* from the affected plants but were unable to produce the disease artificially by the use of isolates. Since a large number of nematodes were associated with diseased roots which were similar to meadow nematode, *Pratylenchus pratensis* (de Mann) Filipjev, they came to the conclusion that the disease was most probably caused by the nematode which was similar in nature to that associated with brown root rot of tobacco as reported by Jenkins (1948) from U.S.A. They considered *Fusaria* to be secondary in nature. However Prasad and Patel (1952) considered the disease to be due to a complex of *F. oxysporum* f. *nicotianae* and *F. solani* f. *nicotianae*. As there was a considerable difference of opinion among the

abovementioned authors, regarding the nature of the disease, a detailed study was undertaken to establish the true nature of the disease.

Symptoms

The most conspicuous field symptom of the disease is the wilting of leaves on one side of the plant (Fig. 2). This is the first indication of the appearance of the disease and is followed by complete wilting of the plant. These symptoms can be observed more clearly in case of 6—8 weeks old plants. The younger plants have been observed to wilt suddenly and the disease involves the entire plant. Affected plants occur generally in patches (vide Fig. 1) and also individually.

Field symptoms of *Chitri* present a close resemblance to *Fusarium* wilt of tobacco but a detailed examination of affected plants revealed certain differences. Outer parenchymatous tissues are generally rotted and this rotting is accompanied by a dark brown discolouration of cortical tissues as well as vascular bundles. Even in a freshly wilted plant, the outer parenchymatous tissues have been found to be affected. In the first instance, only one or two lateral roots are involved but as the disease progresses, the entire root system may be affected. Cortex is sloughed off easily.

* Work financed by Indian Central Tobacco Committee.

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Fig. 1—A general view of a chitri-affected area

Fungus hyphae can be easily seen in the cortical region (vide Fig. 5) while they are observed rarely in the vascular tissues (Figs. 3 and 4). In case of *Fusarium* wilt of tobacco in U.S.A., the hyphae are confined to the xylem vessels and can be observed in other tissues only when the disease has practically destroyed the plant. This fact created a doubt about the nature of this disease and the presence of fungus hyphae in cortex in initial stages of the disease, shows that it cannot be regarded as a true vascular wilt. Similar observations have been recorded by Mathrani, Elias and Kadam (1951). They are of opinion that nematodes similar to *Pratylenchus pratensis* (Fig. 6) attack the plant in the beginning and this is followed by the attack of *Fusaria*. To establish the true nature of the disease, following investigations were undertaken.

Isolation

Chitri-affected plants were collected from various farm sections of the Institute and farmers' fields adjacent to the Institute. The diseased plants were collected at different stages of the disease and large number of isolations were made from different parts of the plant viz. root hairs, lateral roots, main root, foot, stem just above the foot and higher portions of the stem. These isolations yielded a wide variety of fungi. Majority of isolates belonged to the genus *Fusarium* while a few to *Rhizoctonia*. A great deal of variation was found to exist among the different isolates of *Fusarium*. On the basis of external characters viz. colour, presence and absence of aerial mycelium, sporodochia, pionnotes and sclerotia, the isolates could be placed under twenty-six groups. Table 1 shows the basis of these groupings.



Fig. 2—A closeup view of a plant in the early stages of infection

Chitri Disease of Tobacco in Gujarat I

TABLE I
Characteristics of different isolates from Chitri-affected tobacco plants

S. No.	Colour and type of mycelium	Pionnotes	Sporodochia	Sclerotia
1.	Dull white, poor real growth ...	Present	.....	.....
2.	White, good aerial growth ...	.....	.....	.....
3.	Cottony white, good aerial growth, few greenish shiny spots....	Present	.....	.....
4.	Dull yellowish colour, moderate mycelial growth ...	.....	Present	.....
5.	Cottony white, fluffy aerial mycelium ...	.....	Present	.....
6.	White, poor aerial growth ...	.....	Present	.....
7.	White, moderate mycelial growth ...	.....	.....	Present
8.	Dirty white aerial mycelium ...	.....	.....	.....
9.	Slightly pinkish, no aerial growth ...	.....	Present	.....
10.	Dull white, submerged growth ...	Present	.....	.....
11.	Slightly pinkish white with good aerial mycelium ...	.....	.....	.....
12.	White, aerial mycelium...	.....	.....	Present
13.	Cottony white wrinkled growth ...	Present	.....	.....
14.	Dull white with greyish tinge, aerial growth moderate ...	.....	Present	.....
15.	Dull white with violet tinge ...	.....	Present	.....
16.	White, good aerial growth ...	.....	.....	.....
17.	Slightly yellowish, good aerial growth ...	.....	.....	Present
18.	White, slight aerial growth ...	.....	Present	.....
19.	Dirty white, submerged growth ...	Present	.....	.....
20.	White, aerial growth substratum discoloured brown ...	.....	Present	.....
21.	Dull, ash white, poor aerial growth ...	.....	Present	.....
22.	White, good aerial growth ...	.....	.....	Present
23.	White, good fluffy aerial growth ...	.....	.....	.....
24.	Yellowish white pinkish tinge ...	.....	.....	.....
25.	Dull white, slight aerial growth ...	.....	Present	.....
26.	Black with slight aerial growth ...	.....	.....	Present

These isolates were sub-cultured and maintained in a pure condition by single sporing, following the method of Hansen and Smith (1932). Further sub-cultures of these isolates were done only by single spore.

During the course of isolation and examination of diseased parts, certain types of nematodes were also found to be associated. A culture of these nematodes was also maintained. The nematodes could not be separated from *Fusarium* and they were maintained as such.

Pathogenicity

In order to test the pathogenicity of different isolates, an infection experiment was carried out in sterilized soil in pots. Typical *goradu* soil was sterilized at 25 lbs. pressure for one hour. This process was repeated to ensure complete sterilization. 4 weeks old seedlings of tobacco, variety K. 49; raised in sterilized soil, were transplanted in pots containing double

sterilized soil. The soil was examined under the microscope and found to be free from nematodes.

Before transplanting, roots of seedlings, were dipped in spore suspension of 26 isolates. Roots of seedlings in case of control, were dipped in water. After transplanting, the spore suspension was poured round about the seedling. To prevent contamination of one pot from another by splashing of water, the pots were kept at a distance from one another and watering was carried out with great care. Plants in inoculated and control pots, continued to grow in a uniform manner for six weeks. First symptom was observed eight weeks after transplanting and it consisted of yellowing of leaves and later wilting was observed. Rotting of roots could be observed in some cases. The affected plants were comparatively stunted when compared with the controls. Certain differences were observed with different isolates and they are recorded in Table 2.

Fig. 3—Cross section of a root of tobacco showing the presence of fungus hyphae in vessels

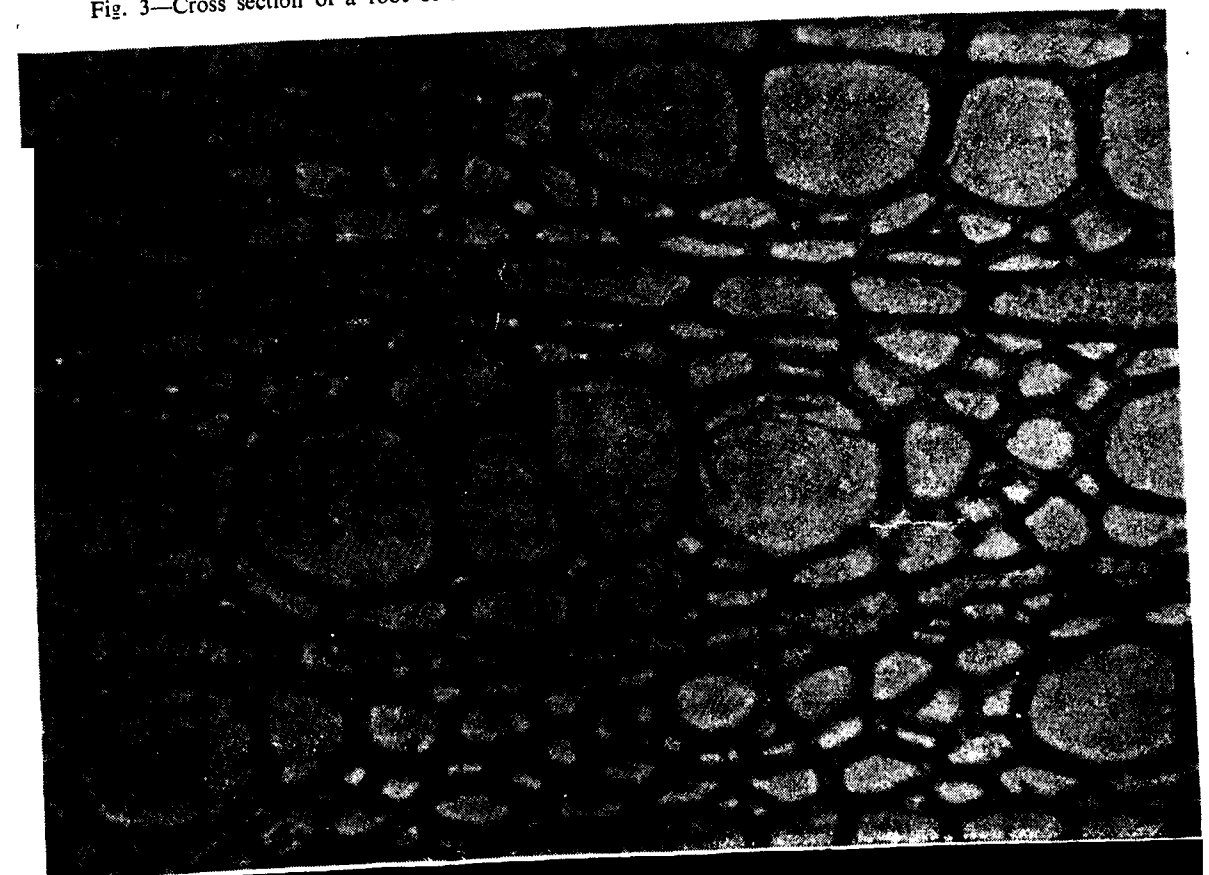


TABLE 2
Infection with different isolates obtained from Chitri affected plants

Culture No.	Symptoms produced					Remarks
1.	Yellowing accompanied by wilt of leaves	...	...	...	...	Stunted growth
2.	No effect	...	...	...	...	.....
3.	Marked yellowing	...	...	...	...	Stunted growth
4.	No effect	...	...	...	...	.....
5.	Marked yellowing followed by complete wilting	...	...	...	...	Poor growth of plants.
6.	Yellowing	...	...	...	...	.....
7.	No effect	...	...	...	...	.....
8.	.....	...	...	...	...	.....
9.	Severe wilting	...	...	...	...	Very stunted growth
10.	No effect	...	...	...	...	.....
11.	Marked yellowing	...	...	...	...	Poor growth
12.	No effect	...	...	...	...	.....
13.	Severe wilting	...	...	...	...	Stunted growth
14.	No effect	...	...	...	...	.....
15.	.....	...	...	...	...	.....
16.	Yellowing	...	...	...	...	Stunted growth
17.	No effect	...	...	...	...	.....
18.	Marked yellowing	...	...	...	...	Stunted growth
19.	No effect	...	...	...	...	.....
20.	.....	...	...	...	...	.....
21.	Severe wilting	...	...	...	...	.....
22.	No effect	...	...	...	...	.....
23.	Yellowing followed by wilting of few leaves	...	...	...	...	Stunted growth
24.	No effect	...	...	...	...	.....
25.	Wilting of lower leaves	...	...	...	...	.....
26.	No effect	...	...	...	...	.....
Controls	All were healthy	...	...	...	...	.....

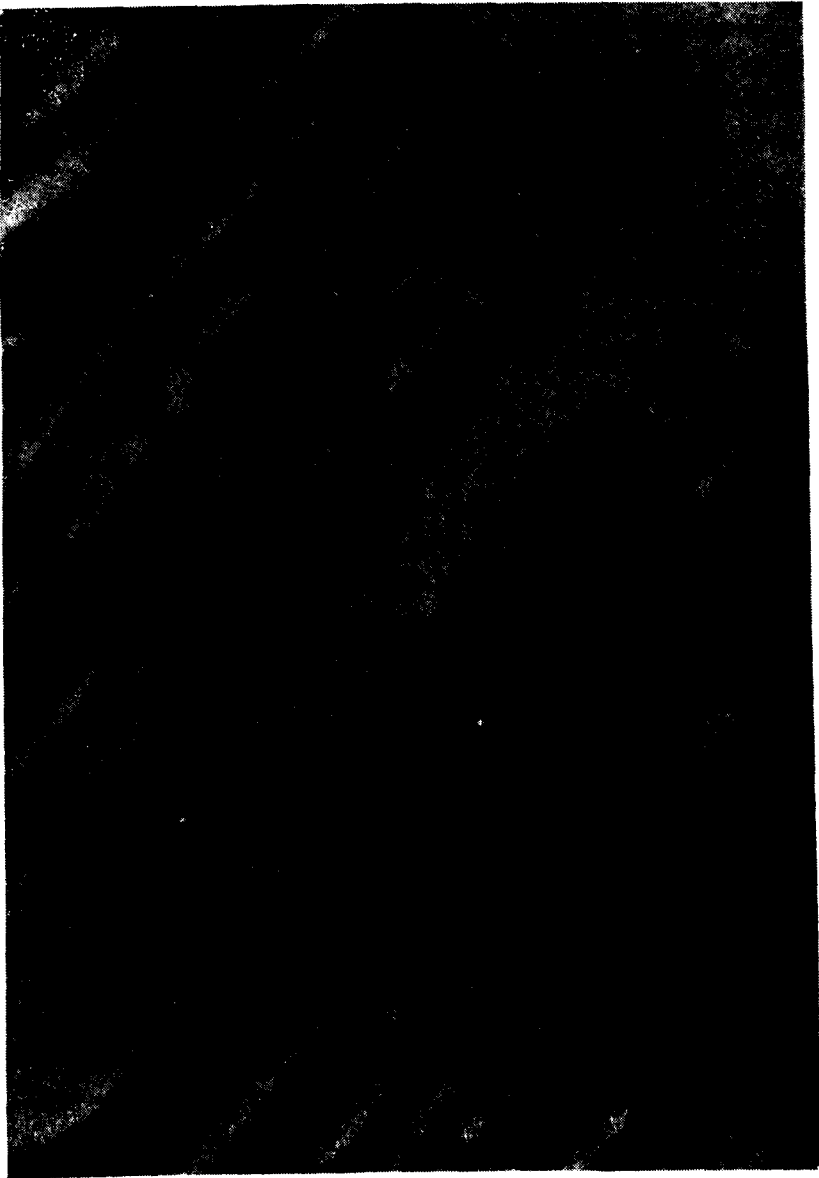


Fig. 4—Longitudinal section of a root of tobacco showing the presence of fungus hyphae in vessels



Fig. 5—Cross section of a root showing the presence of mycelium in parenchymatous tissues

The plants which showed some signs of the disease were picked up and isolations were carried out from each one of them. Cultures of *Fusaria* were invariably obtained from each and these were compared with the original cultures and were found to resemble them. Isolate Nos. 3, 5, 6, 9, 11, 13, 18, 23 and 25 caused yellowing followed by wilting and brown discolouration was observed in vascular tissues. Isolate Nos. 1, 16 and 21 caused rotting of roots. Isolate No. 26 was *Rhizoctonia* sp. and it failed to cause any symptom of the disease.

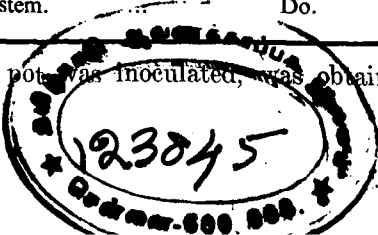
The twelve isolates which caused some symptoms in the above experiment, were selected for further study. Uniform seedlings of tobacco variety K. 49 raised in

sterilized soil which was free from nematodes, were inoculated in the manner described earlier with each of the above isolates and were transplanted in double sterilized soil. Two seedlings were transplanted in each pot. The roots of seedlings were examined under the microscope and found free from nematodes. Two pots were infected with each isolate. Twelve pots were kept as control. First visible symptom appeared eight weeks after transplanting (Figs. 7 and 8). As the disease progressed, one plant from each pot was carefully pulled out and was examined for the presence of fungus mycelium in different tissues of the plant. The observations recorded in the experiment are presented in Table 3.

TABLE 3
Infection experiment with 12 isolates of *Fusarium*

S. No.	Isolate No.	No. of plants inoculated	No. of plants wilted	Tissues in which mycelium present	Remarks
1.	1	4	4	Root parenchyma	Gradual wilting.
2.	3	4	4	Root parenchyma few hyphae in xylem.	Drying of lower leaves.
3.	5	4	4	Vessels of roots and stem	Gradual wilting.
4.	6	4	4	Vessels and parenchyma of both stem and roots.	Do.
5.	9	4	4	Root vessels	Do.
6.	11	4	4	Vessels and parenchyma of roots and stem.	Do.
7.	13	4	4	Do.	Do.
8.	16	4	4	Root vessels and parenchyma	Do.
9.	18	4	4	Do.	Do.
10.	21	4	4	Root parenchyma and few hyphae in root vessels.	Gradual wilting accom-drying lower leaves.
11.	23	4	4	Present in parenchyma and vessels of both root and stem.	Wilting of entire plant.
12.	25	4	4	Vessels of roots and stem.	Do.

Isolations were carried out from each pot and the type of *Fusarium* with which that particular pot was inoculated, was obtained in culture.



As the type of symptoms produced in case of individual isolates did not resemble exactly with those found in nature, it was thought desirable to mix the isolates and also to make a mixture of *Fusarium* isolates along with *Rhizoctonia* and nematodes. It was considered that this experiment might throw some light on the possible role of nematodes in this disease. Seedlings of K. 49 variety of tobacco were raised, inoculated and transplanted in the manner described before. The first symptoms of the disease were observed eight weeks after transplanting. In certain cases, it was a few days earlier or later. The observation recorded in the experiment, have been presented in Table 4.

TABLE 4
Inoculation with *Fusarium* mixture along with *Rhizoctonia* and nematodes

S. No.	Type of inoculum	No. of plants inoculated	No. of plants wilted	Remarks
1.	<i>Fusarium</i> mixture	...	6	Mycelium present in vascular and parenchymatous tissues of stem and root.
2.	<i>Rhizoctonia</i> alone	...	...	No symptoms observed.
3.	* Nematodes alone	...	...	Do.
4.	<i>Fusarium</i> mixture + Nematodes.	...	6	Mycelium present all over roots and stem.
5.	<i>Fusarium</i> mixture + <i>Rhizoctonia</i> .	...	6	Do.
6.	<i>Fusarium</i> mixture— + <i>Rhizoctonia</i> + Nematodes	...	6	Mycelium present all over roots and stem.
7.	<i>Rhizoctonia</i> + Nematodes.	6	...	No symptom observed.
8.	Uninoculated controls	...	12	All plants were healthy.

* This contained large number of nematodes along with *Fusarium* and it is likely that it was a saprophytic one.

From the above experiment, it can be clearly seen that the disease occurs only when cultures of *Fusaria* are present. *Rhizoctonia* sp. and nematodes in absence of *Fusaria* are unable to cause any damage to the plant. The general appearance of the disease in case of mixture of different isolates of *Fusarium* had a close resemblance to that found in nature. It is therefore likely that the disease in nature is caused by combined attack of different types of *Fusaria*.

Role of nematodes in disease complex

It has been observed that nematodes are generally associated with diseased plants in nature. Jenkins (1948) considers brown

root rot of tobacco in U.S.A. to be caused by the feeding of ectoparasitic nematodes. Mountain (1954) has demonstrated convincingly that nematodes cause this disease in Canada. Similar relationship has been shown in case of wilt of cotton by Neal. To understand whether or not, the nematodes play any definite role in this disease complex, an experiment in a heavily chitri affected area, was carried out on the college Farm of the Agricultural Institute. The affected portion was divided into four equal plots and two of these were fumigated with shell D.D. which is a powerful nematocide. 10 cc of the nematocide was placed at a distance 10 inches by means of a shell injector gun.

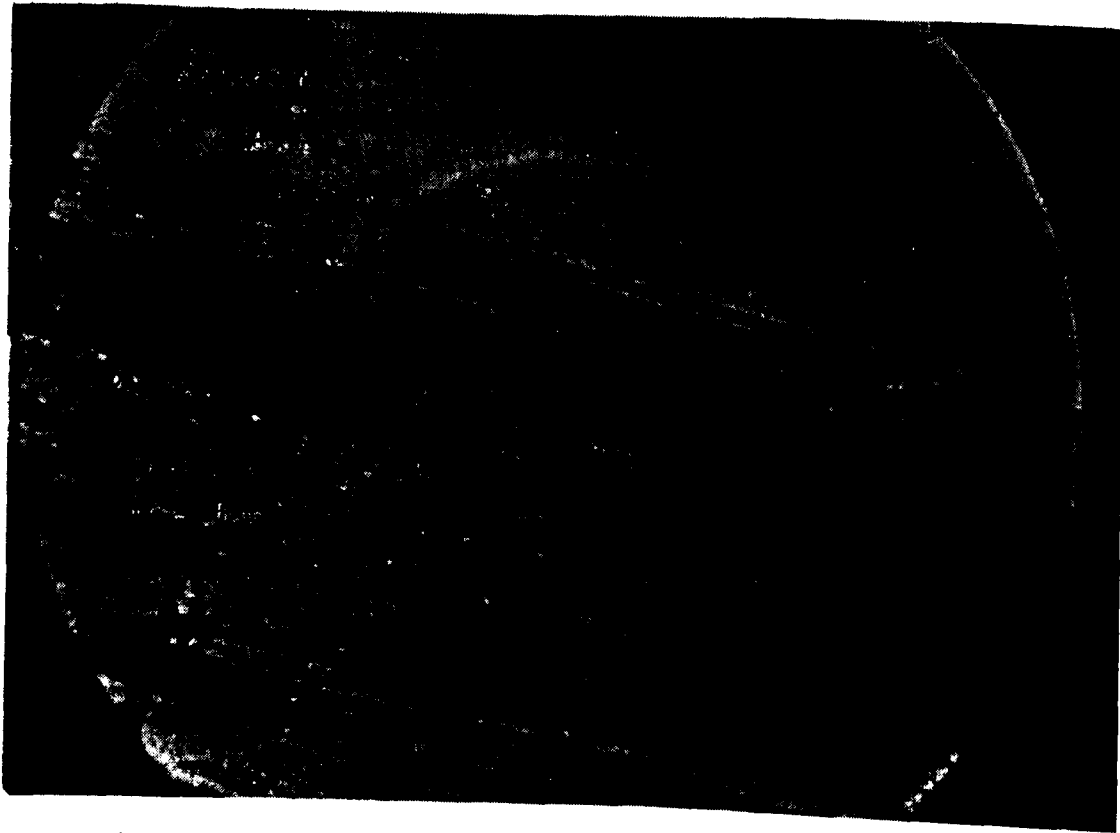
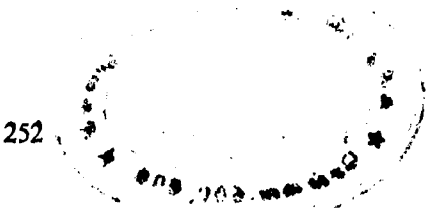


Fig. 6—Longitudinal section of parenchymatous tissues showing the presence of nematodes



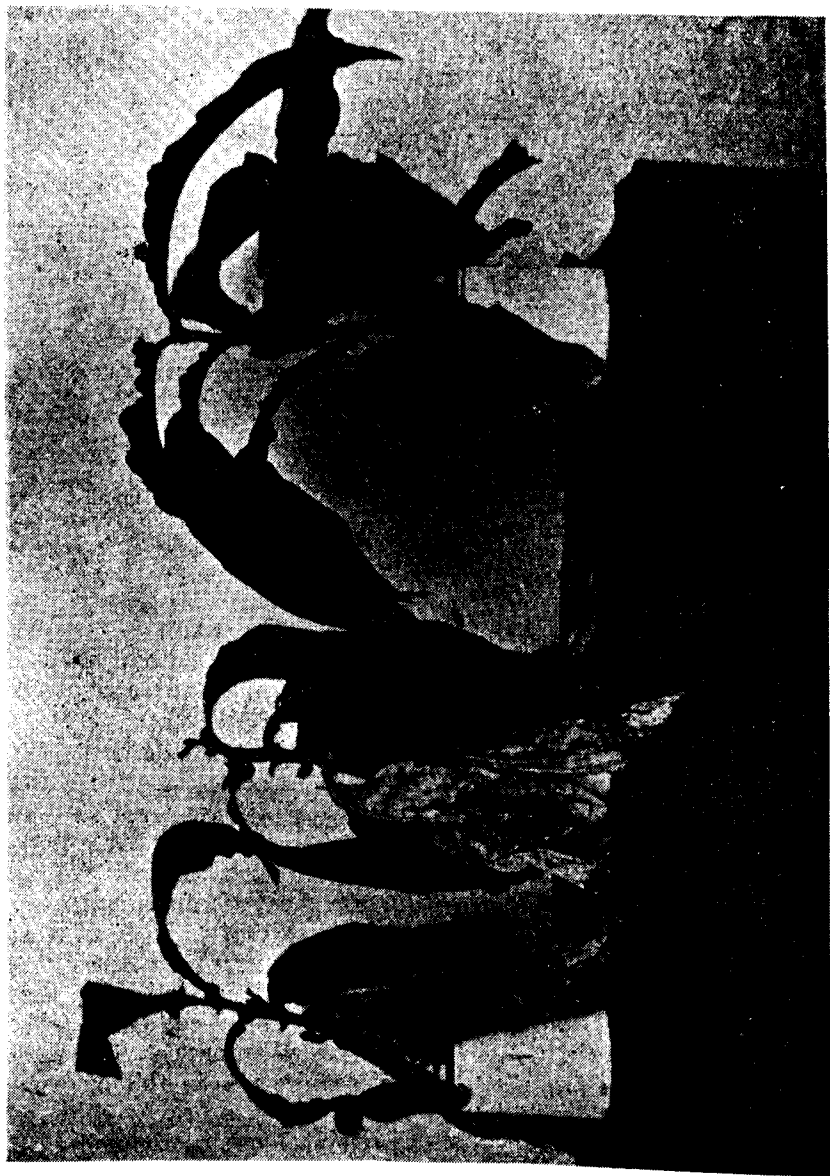


Fig. 7—Artificial production of the disease by use of different isolates of fusarium.



Fig. 8—Artificial production of the disease by use of different isolates of fusarium.

This dosage amounted to almost 75 gallons per acre while a normal dose for controlling nematodes usually never exceeds 40 gallons per acre which has been used successfully in these soils for elimination of root knot nematode. The disease appeared by middle of October and continued to increase till the third week of November when final counts of healthy and diseased plants in each plot was taken and they are recorded in Table 5. The experiment was carried out during two years in different areas on the Institute Farm.

TABLE 5

Comparison of number of affected plants in fumigated and unfumigated chitri affected area

Year	S. No.	Location	Total No. of plants	No. of affected plants
1954-55	1	Lambhyel Farm—		
		Fumigated	28	10
		Untreated	28	11
	2	Institute Farm—		
		Fumigated	48	21
		Untreated	48	27
1955-56	3	College Farm—		
		Fumigated	144	69
		Untreated	144	129

From the above table it can be clearly seen that fumigation with shell D.D. made absolutely no difference in the first two cases. While during 1955-56 there was reduction in the incidence of the disease but still the disease destroyed 48 per cent of the plants. A review of literature on the relevant subject shows that ectoparasitic nematodes increase the incidence of the disease and it therefore appears reasonable to conclude that the nematodes by their presence in large numbers may make the host plant much more susceptible. The real damage to the plants is caused by the fungi.

Taxonomy of pathogenic isolates

The twelve strains which were found to be pathogenic were selected for detailed study. Nine strains 3, 5, 6, 9, 11, 13, 18, 23,

and 25 were mostly associated with the vascular tissues and in artificial inoculations, were prominent in the vascular regions. They were characterised by the presence of white to dirty white or pinkish white mycelium, pale brownish, cream coloured or faint bluish sporodochia; oval ellipsoid straight or kidney shaped micro-conidia; macroconidia oblong spindle shaped, narrow at both ends and pointed towards apex, sickle-shaped or hooked, almost cylindrical at centre, conidial walls and septa tender. Both terminal and intercalary chlamydospores were present. The above characters place all the above isolates in the section *Elegans* of Wollenweber and Reinking's system of classification. The section is equivalent to *Fusarium oxysporum* of Snyder and Hansen. We have followed the latter classification and thus name all the above

isolates as *F. oxysporum* Schl. emend Sny. et. Hans. f. *nicotianae*.

The isolates 1, 16 and 21 are more commonly associated with parenchymatous tissues and in culture are characterised by conidia with thick walls and septa, obtuse to obliquely rounded at the apex, Chlamydospores both terminal and intercalary. These characters place these three strains under section *Martiella* of Wollenweber and Reinking which is equivalent to *F. solani* of Snyder and Hansen. The three isolates therefore belong to *F. solani* Appel et. Wr. emend Snyd. et. Hans. f. *nicotianae*.

Discussion

Presence of rotting of cortical regions in the freshly wilted plants clearly shows that the disease is not comparable to typical *Fusarium* wilt caused by *F. Oxysporum* f. *nicotianae* as recorded by Uppal, Patel and Kamat. Isolations and infection experiments carried out show the presence of two types of isolates. One type belonging to typical wilt causing and other to typical root rot causing *Fusaria**. The study of symptoms and the presence of fungus mycelium in different tissues of the host, also points towards the complex nature of the disease.

The presence of nematodes along with diseased plants caused a doubt whether or not, the fungi are the real cause of the disease. Similar fungus and nematodes complex has been reported in number of cases e.g., root rot of cotton, wilt of cotton. It was earlier stated that both of these diseases were caused primarily by fungi and that nematodes did not play any significant role in the disease complex. Recently the study of ectoparasitic nematodes has been undertaken more seriously and we are in possession of clearer conception of the role played by the nematodes. It has been shown that nematodes by feeding on the roots, make

the entry of the fungi easier. In case of cotton, wilt resistant varieties become susceptible to *F. vasinfectum* (1954) but the susceptible varieties succumb to the attack of fungi even in total absence of the nematodes. We have carefully conducted the experiments and avoided the presence of nematodes and we find that it is possible to produce the disease by the use of fungi. Fumigation of chitri affected areas with D.D. a powerful nematocide has not resulted in the control of the disease. From the information collected over a period of five years, it therefore appears reasonable to conclude that the disease is complex of root rot and wilt where root rot is probably more dominant. The manifestation of the disease is helped by the presence of nematodes.

Summary

Chitri disease of tobacco is characterised by wilting of a few leaves on one side in a large number of cases. Total wilting of plant is also frequent. Out of large number of isolations, twelve strains of *Fusaria* were found to be pathogenic. The strains when mixed together produced the disease under artificial condition very similar to that found in nature. Nematodes though present in nature were not necessary for the production of disease in pots. Fumigation of chitri affected patches with a dose as high as 75 gallons per acre of shell D.D. soil fumigant, failed to control the disease.

The twelve pathogenic strains could be placed under two species of *Fusarium* viz. *F. oxysporum* f. *nicotianae* and *F. solani* f. *nicotianae*. The nematodes when present stimulate the production of the disease.

Acknowledgment

The authors are indebted to Dr. M.D. Patel, Director, Agricultural Institute, Anand for keen interest in these investigations and for the facilities provided.

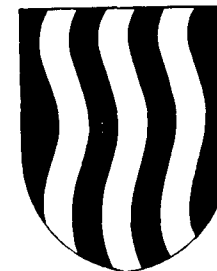
* The study supports the earlier contention of Prasad and Patel that the disease is a complex of wilt and root rot.

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TABLE 1

Hills	Stations	Elevation mean sea level.	Soil	Shade	Trans- planted on
Kannivadi Palani range	Thonimalai	4,750'	Rich in humus	Banana, Orange & Coffee.	21-10-1955
Kodaikanal	Uralpatti	4,500'	Do.	Do.	11-11-1955
Do.	Aladipatti	4,500'	Do.	Do.	11-11-1955
Anamalai	Mount Stuart	4,500'	Sandy ; no humus	No shade	18-10-1955
Do.	Kannivadi plains	200'	Sandy loam.	Do.	21-10-1955

In all the places variety R. G. was transplanted. Seedlings were raised at the Research Station. After transplanting no other cultural operation was attended to except in Mount Stuart where mummy digging was given six weeks after transplanting.

Leaves were primed as and when they were ready, packed in banana sheaths, and brought down to Research Station for curing. Curing was done in a dark room under conditions of humidity which varied from 68 per cent to 78 per cent. In about 15 days

the leaves were cured and the cured leaves were stored in a deal wood box before they were tested for their burning quality and other traits.

Method of scoring :—A system which is in vogue with the Chemistry section of this Research Station, and which is a modification of the system evolved by Johnson (1941; 1944) was adopted. According to this system the quality of wrapper (this holds good for cigar and cheroot fillers as well) is estimated under the following heads :—

			Marks
1.	Ash	Colour :—White, white grey, grey, dark grey, black	15
		Size :—Enlarged, unchanged, reduced	6
		Coherence :—Firm, Medium, Flaky.	6
2.	Burn	Time :—5 minutes down to 1 minute	15
		Evenness :—Even ; Medium ; uneven	6
		Margin :—Narrow, Medium, Broad	6
		Rate :—Medium, Fast, Slow	6
3.	Smoking quality	Taste :—Smooth and soft ; medium ; sharp and rough ; rough and biting	16
		Aroma :—Pleasant, Neutral, unpleasant	9
		Strength :—Mild, Medium, Strong	6
		Total	40

To estimate the thickness of the leaves about 25 leaves from each sample were taken at random and conditioned. The leaves were well stretched and the area measured. Afterwards, the mid-ribs were removed and the leaves dried in hot oven at 70° C. The dried leaves were weighed. Thickness was calculated in grams per square metre, as per Goff's (1894) formula which is as follows :

$$\frac{\text{weight in grams} \times 10,000}{\text{Area of leaf in square centimeter}}$$

For chemical analysis 20 leaves from each sample taken at random were dried and powdered and sieved through a mesh 40 gauze.

Smoking quality was determined as per the schedule already given. Eight cigars from each sample of wrapper with the research station filler and binder (variety : vellaivazhai) were tested and the figures given are the average score for these eight cigars.

Results :—The physical qualities of the wrapper leaves of the samples are summarized in the following tables :—

TABLE 2

Physical qualities of the wrapper leaves grown at Hill stations

Name of the samples/ cheroot No. (1)	Thonimalai 1954-55 (2)	Thonimalai 1955-56 (3)	Uralpatti 1955-56 (4)	Aladipatti 1955-56 (5)	Mount Stuart 1955-56 (6)	Kannivadi 1955-56 (7)
1.	Light brown with yellowish tinge, lustre moderate	Light brown with yellowish tinge, lustre moderate	More of yellowish than brownish.	Brown, lustre good	Snuff coloured	Kraft in colour.
2.	Do.	Do.	Dark brown resembling Sumatra, wrapper.	Brown on the greenish side, lustre good.	Do.	Do.
3.	Do.	Brown, lustre good.	Light brown with yellowish tinge.	Do.	Do.	Do.
4.	Do.	Light brown with yellowish tinge, lustre moderate.	Do.	Brown with yellowish tinge, lustre moderate.	Do.	Do.
5.	Do.	Do.	Dark brown resembling Sumatra wrapper.	Brown, lustre good.	Do.	Do.
6.	Do.	Do.	Light brown with yellowish tinge.	Light brown, lustre good.	Do.	Do.
7.	Brown colour, lustre moderate.	Do.	Do.	Do.	Do.	Do.
8.	Light brown with yellowish tinge, lustre moderate.	Do.	Dark brown resembling Sumatra wrapper.	Do.	Do.	Do.

TABLE 3
Giving the Physical, Ash, Burning and Smoking qualities of the leaf

Name of the sample	Average		Area of the leaf in sq. cm.	Thickness of the leaf (in grams) per sq. metre)	Ash quality			Burning quality			Smoking quality			Total cigar burn score.	Average leaf burn in seconds	
	Length	Breadth			Colour	Size	Coherence	Time	Evenness	Margin	Rate	Taste	Aroma			Strength
Thonimalai 1954-55.	N.A.*	N.A.*	N.A.*	N.A.*	4.25	2.00	1.75	4.13	2.00	1.25	2.75	6.25	5.00	2.88	32.25	24.50
Thonimalai 1955-56.	29.30	14.95	295.10	43.46	4.25	1.88	1.63	3.25	2.13	1.25	2.50	5.50	5.00	3.00	30.38	29.34
Uralpatti 1955-56,	30.76	15.33	316.30	32.89	3.13	2.13	2.38	3.00	2.63	2.25	3.00	5.25	4.50	3.00	31.25	24.13
Aladipatti 1955-56.	26.26	12.66	222.51	30.56	2.50	1.88	2.50	3.38	1.88	1.63	2.75	5.75	4.75	3.00	30.00	29.15
Mount Stuart 1955-56.	27.95	12.66	234.69	48.57	2.00	1.88	1.50	3.50	1.88	1.38	2.00	3.00	3.00	3.00	23.13	6.84
Kannivadi 1955-56.	44.92†	22.23†	665.54†	28.29†	2.25	1.88	1.75	1.75	2.00	1.13	1.63	3.00	2.25	1.75	19.38	3.40

N.A.—Not available.

* For want of sufficient sample, the leaves 1954-55 season could not be determined for thickness and area.

† Only six leaves were available for determining the thickness and area of the leaf.

The results of the chemical analysis are given in the following table:—

TABLE 4
Chemical analysis for 5 samples of Wrapper leaves
(The results are on oven dry and sand free basis)

Sample	Per cent on oven dry basis.	Per cent soluble ash	Chlorine per cent	K ₂ O per cent	Average score for smoking quality	Average score for leaf burn
Thonimalai ...	20.38	17.32	0.235	3.886	30.38	29.34
Uralpatti ...	19.17	17.56	0.292	5.383	31.25	24.13
Aladipatti ...	21.17	19.33	0.290	6.760	30.00	29.15
Mount Stuart ...	13.92	11.64	1.123	3.827	23.13	6.84
Kannivadi ...	23.52	19.44	4.429	4.700	19.38	3.40

Discussion and conclusion :—From our pilot experiments it has become evident that cultivation of wrapper tobacco at higher altitudes in hills is a feasible project. It may be noted from Tables 3 and 4 that the quality of wrapper produced at Thonimalai, Uralpatti and Aladipatti are quite good and come up to the standard of expectancy. Thonimalai wrapper gives all the desirable traits excepting the colour which it would not be difficult to introduce either by controlled curing or other means. The thickness of Thonimalai wrapper, it is true, is slightly more than the ones obtained from Uralpatti and Aladipatti, but to compensate this it has excellent burning quality aroma and ash. Probably with a carefully planned experiment it would be possible to obtain thinner leaves even at Thonimalai.

The chemical analysis reveals that in the three quality wrappers viz., Thonimalai, Uralpatti and Aladipatti there is a very low percentage of chlorine and sufficient quantity of potash. This corroborates the findings of Johnson (1941:1944) who states that a low percentage of chlorine is one of the attributes for a good burning wrapper leaf. It may also be noted that in the Kannivadi plains and Mount Stuart wrappers, the percentage of chlorine is appreciably high. In Kanni-

vadi plains where it is 4.429 the corresponding average leaf burn is 3.4 seconds and in Mount Start where it is 1.123 the average leaf burn is 6.8 seconds. The potash content in all the samples is high enough ranging from 3.827% to 6.760% . It appears, therefore, that it is just not the potash content alone that determines burning quality but it is the low percentage of chlorine associated with an optimum potash requirement. It may be noted from Table 4 that the higher percentage of potash from Aladipatti sample has not, in any measure, contributed to an increase in burning quality than either, Thonimalai or Uralpatti. It is, therefore, presumed from these figures that with an optimum potash content, all leaves burn well provided the chlorine content is low enough, and that the increase in potash above the optimum does not alter in any appreciable manner the burning quality.

In regard to thickness also the data reveal that it is not such a handicap in burning quality—even though it does bring down the value of the wrapper leaf from other considerations. Kannivadi leaf which was the thinnest had the poorest burning quality while Thonimalai which had a higher value for thickness had the best burning quality.

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INDIAN CENTRAL SUGARCANE COMMITTEE

(Ministry of Food and Agriculture, Government of India)

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POSSIBILITIES OF WRAPPER TOBACCO CULTIVATION IN HILL STATIONS-- A PRELIMINARY STUDY

BY

D. M. GOPINATH* AND N. J. HRISHI†

When the cigar and cheroot tobacco research station at Vendasandur was opened in 1948 it was with the idea of exploring the possibilities on wrapper tobacco cultivation along with research on cigar and cheroot tobacco. However, after three years of trial, during which wrapper tobaccos were grown under burlop cloth and mosquito net shade, it was found that even though excellent quality leaves in so far as thinness, colour, size were concerned could be grown, the primary requisite which makes a wrapper leaf what is—namely the burning quality, ash, aroma, etc., was so dishearteningly poor that it was felt not desirable to continue the experiments any further at Vendasandur. In 1954, however, an idea came to the mind of the senior author that perhaps it would be possible to grow wrapper tobacco at higher altitudes where climatic conditions would be very different from what it would be in the plains and where advantage of natural shade in coffee and banana plantations could very well be utilized. The report that follows is the result of two years experimentation in this direction during which period pilot projects were undertaken to find out the feasibility or otherwise of wrapper tobacco cultivation at higher altitudes.

With the co-operation of an enlightened farmer facilities to grow wrapper tobacco

was obtained at Thonimalai hills in the season 1954-55. Thonimalai is in the Palani range with an altitude of approximately 4,750 feet above mean sea level and is reputed for its intensive coffee and banana cultivation. A plot of the size 25' × 40' in two different places were obtained and in both the plots varieties 15 × 17G and R. G.—the two standard varieties available at this station were planted. No special care was taken after transplanting, occasional irrigation being given from a small stream flowing nearby. The leaves were primed after about three months when flowering was in progress and cured in the Research Station in a dark room keeping an average humidity of 78 per cent. The curing it must be admitted, was of a crude type as we could not command facilities for a controlled curing chamber. The average burning time of this wrapper was 24.50 seconds, and the ash colour was white with excellent cohesive property and having a pleasant aroma. No systematic analysis of this wrapper was conducted the purpose of the pilot project being only to get information whether wrapper tobacco would grow at all on hill tops.

Encouraged by the results obtained a more elaborate but still only a pilot project was conducted in the following places during the season 1955-56.

* Botanist, Cigar & Cheroot Tobacco Research Station, Vendasandur.

† Botanical Assistant, Cigar & Cheroot Tobacco Research Station, Vendasandur.

In Mount Stuart, inspite of the elevation, the quality of the wrapper leaves produced was very poor. The reason for this is attributable to the soil type. While in Thonimalai, Uralpatti and Aladipatti the soil was of a rich humus type in Mount Stuart the soil was sandy and poor in organic and possibly inorganic constituents. The ash figures (Table 4) reveal this important fact. The percentage of ash in the leaf (on oven dry basis) is an index of the mineral nutrients present in the soil. In the Mount Stuart sample the ash figure is 13.92 per cent, lowest recorded from amongst the samples under report. Kannivadi sample which gives 23.52 per cent is the highest. In Kannivadi the soil is of a sandy loam and the irrigation was done through a well which had brackish water. The other samples ranged from 19.17% to 21.17%. These, as also the Mount Stuart sample, were irrigated by spring water which was soft. This explains the low ash content in Mount Stuart sample, as compared with Thonimalai, Uralpatti and Aladipatti sample. From this it appears that the low burning quality of Mount Stuart leaves is due to deficiency of humus in soil, showing thereby that it is not only the altitude but also the nature of the soil which is important in producing good quality wrapper leaves.

It is, therefore, concluded that wrapper leaves of quality could be grown at higher altitudes under banana, orange and coffee plantation shade and it would be worthwhile to continue the experiment in a more systematic way.

Summary :—With a view of finding out the feasibility of wrapper tobacco cultivation

in hills, pilot projects were carried out in four stations on hills.

Leaves produced at Thonimalai, Uralpatti and Aladipatti have good burning quality.

Leaves produced at Mount Stuart and Kinnavadi plains were poor.

There is a relationship between the low chlorine per cent in leaf and optimum potash content which determines the burning quality.

It has been observed that altitude alone is not the determining factor for production of quality leaves but the soil type as well.

It is concluded that quality wrapper could be grown in hill stations under certain conditions.

Acknowledgment :—Our thanks are due to Messrs. Bombay Burmah Trading Co., Mount Stuart, Thirumalasami Reddiar, Kannivadi and Thonimalai; P. P. S. Varadarajulu, Uralpatti and T. P. R. Subban Chettiar, Aladipatti for their kind co-operation and interest in the conduct of this trial.

Our sincere thanks are due to Sri A. S. Sastry, Chemist and Sri M. Venkateswaran, Junior Scientific Assistant in Chemistry, for kindly analysing the leaf samples for chemical composition.

Our grateful thanks are due to Dr. N. R. Bhat, Director, Tobacco Research, Rajahmundry, for the very keen interest he evinced in the project and for his constant encouragement.

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Take Care of your Storage Premises, Cigarette Beetle can live part of its life in the dust outside the Tobacco Storage

BY

ANNAMMA PHILIP AND D. P. PARKHE

(Central Tobacco Research Institute, Rajahmundry)

The Cigarette beetle *Lasioderma serricorne* is a major pest of storage tobacco. The life cycle of the beetle consists of the egg stage, larval stage which is the feeding stage, the pupal stage and the adult stage that is the beetle. The larvae or the Cigarette beetle grubs when full grown usually make a cocoon and pupate inside. The pupae when mature emerge as beetles.

In a Tobacco Storage, infestation of larvae and beetles occurs when there is tobacco. Whether the beetle can exist in the storages and their immediate premises even if there is no tobacco stored, has been engaging our attention during the control studies of the Cigarette Beetle. This led us to conduct tests to see whether a full grown larvae can

pupate in ordinary soil dust without any tobacco. Along with soil dust, pupation was also studied in tobacco dust and wheat flour yeast which formed the other two treatments. Three full grown larvae (Fig. 1) were allowed to pupate in a glass vial of 4" × 1" each vial containing a treatment and each treatment was replicated 10 times. Two series of tests were conducted.

From the tests it is seen that larvae can make cocoons of soil and pupate (Fig. 2) even in ordinary dust which is free from tobacco. Therefore, it becomes very essential to take appropriate control measures and check the growth of cigarette beetle in the dust, in and around the storages where the tobacco is stored.



Fig. 1—Full grown larvae of cigarette beetle.

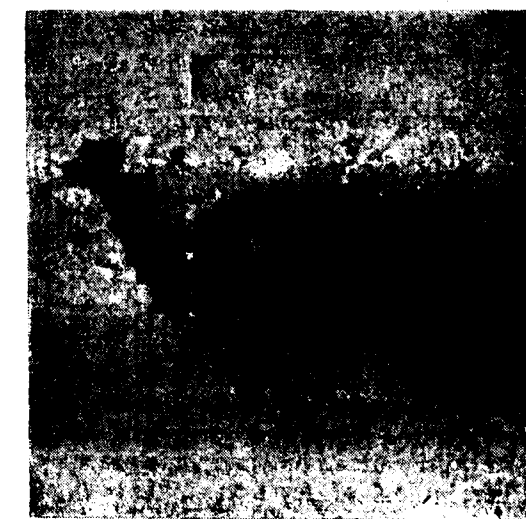


Fig. 2—Soil cocoons formed by the cigarette beetle larvae.

Expert Committee on Tobacco

Government of India, Ministry of Finance (Department of Revenue)

New Delhi, the 2nd November, 1957

RESOLUTION

Central Excises

F. No. 32/6/57-CXI—In pursuance of the recommendation of the Taxation Enquiry Commission (1953-54) the Government of India in the Ministry of Finance, Department of Revenue, Resolution No. 20/8/55—CX, dated the 17th January, 1956, set up an Expert Committee on Tobacco under the chairmanship of Shri K. Raghuramaiah, M. P. to review generally the Departmental procedures in force for assessment of duty on tobacco other than flue-cured on the basis of its capability of use or otherwise for the manufacture of biris, read with the notified and executive concessions authorised by the Central Board of Revenue. The Committee was also asked to consider generally the methods adopted for estimating the produce of tobacco growers for purposes of accounting and assessment and to recommend measures for remedying the defects, if any, in the existing methods and in addition to this, to examine and report on other matters germane to this investigation. The Committee's report was submitted to the Government on March 30, 1957, and has been examined.

2(a) As regards the main term of reference the committee has conducted an exhaustive survey of the methods adopted for classification of varieties of tobacco for purposes of assessment on the basis of percentage of use for the manufacture of biris in specified areas. It has reported that under this scheme, accurate classification of varieties of tobacco for purposes of assessment is not possible and there is no practical method of settling disputes regarding classification of varieties; the scheme has, moreover, given rise to discrimination and malpractices resulting in loss of revenue. It is also of

the opinion that restrictions on the movement of lower rated tobacco from one area to another where it is assessable at the higher rate has resulted in flow of trade from higher rated to lower rated areas, causing hardship to certain varieties of tobacco.

2(b) The Expert Committee has, therefore, recommended that in order to provide a uniform and stable basis of assessment, varieties which, by reason of their physical form and characteristics viz., tobacco cured in whole leaf form and tied or packed in bundles, bunches, hanks etc. or in the form of ropes, twists, or coils; dust of tobacco; granule of tobacco not larger than 1/16" sq. in size (including similar granule of stems); and uncrushed stems larger than 1/4" in size, are incapable of being used in the manufacture of biris, should be assessed at the lower rate and all broken leaf grades larger than 1/16" sq. in size and stems of tobacco larger than 1/16" and not larger than 1/4" in size should be assessed at the higher rate. While some hardship may be caused to inferior broken leaf grades, there is no case for giving them any preferential treatment. If the lower rate of duty was sought to be claimed on such grades, the Committee reported, such grades can be crushed into the form of granules.

3. With regard to growing and curing of tobacco, the Committee is of the opinion that the methods adopted for estimating the produce of tobacco growers for purposes of accounting and assessment are not adequate. To prevent leakage of revenue, it has made the following recommendations for augmenting the existing control :—

(a) (i) The excise staff should, where necessary, be provided with

tapes and scales for measuring area and for weighing of curers produce.

(ii) In areas of high revenue potential and unwieldy jurisdictions motor transport should be provided to excise staff.

(b) (i) In order to provide a firm basis for dealing with cases of under declaration of produce by curers, Inspectors and Supervisory staff should note the condition of the crop on an enhanced scale as well as in a fuller way, and damage to crop by natural occurrences should be fully and carefully investigated.

(ii) All such data should be attested by the grower and other respectable witnesses.

(iii) Crop cutting experiments should be done on an extended scale to determine the correct potential yield of tobacco in each area.

(iv) Weighment of curers' produce should be done on an enhanced scale with increasing size of the crop. Where possible calculations of weighment or by volumetric conversion should be done.

(c) In areas where arrears of revenue are high, besides taking special measures for liquidating arrears, special sanctions should be adopted against habitual defaulters.

(d) Unproductive work involved in registration of garden cultivators who grow tobacco only for personal consumption should be eliminated and the workload in other areas should be reviewed for intensifying excise control.

(e) The scheme of registration of growers in collaboration with State revenue officials operating in parts of U. P. and Rajasthan has proved a failure.

4 (a) The Committee has also inquired into several other matters germane to the object of its inquiry. Chief amongst these pertain to:

(i) restrictions on processing of tobacco in warehouses.

(ii) relaxation of time limit for storage of tobacco in Curers' Bonded Storerooms and in curers' premises :

(iii) decision of Central Excise cases, appeals and revision petitions by an independent authority.

(b) (i) As regards restriction on processing of tobacco in warehouses, the Committee has recommended that processing of tobacco into a form in which it would attract the lower rate of duty should be freely permitted;

(ii) As regards the time limit for storage of tobacco, the Committee has recommended that instead of the present statutory time limit for retention of tobacco in Curers Bonded Storerooms, provision should be made under the Central Excise Rules for granting extension of such time limit. The Committee has not favoured any general extension of the present time limit for storage of tobacco in curers' premises.

(iii) As regards decision of Central Excise cases and appeals, the Committee is of the opinion that the present practice of departmental adjudication may continue but decision of revision petition should be done by a tribunal.

(Continued on page 272)

Seminar on production and processing of Tobacco Seed

A seminar on the production and processing of tobacco seed was held on 8th July 1957. Dr. N. R. Bhat, Director, Tobacco Research, presided. Shri I. V. G. Krishnamurthy, Training and Demonstration Officer, was the main speaker. Dr. N. S. Reddy of Indian Leaf Tobacco Development Co., Ltd., and his associates attended the meeting.

Shri Krishnamurthy stressed the importance of using seed of recognised varieties in the case of a crop like tobacco where quality was the crux of the outturn. He said that mixtures could take place either in the nursery bed or in the field. Once off type plants of lower quality got into the field, they could further produce undesirable natural hybrids lowering the quality of the commercial crop to varying degrees. In the flue-cured tobacco tract of Andhra Pradesh, cultivators in certain regions had taken a fancy for certain low quality types such as 'Guba', 'Dhone', 'Karedu' and 'Puteha' which are of unknown origin, under the impression that these types were giving higher yields and more bright leaf. The experience at the Institute's farm had shown that their notions were fallacious. Experience had shown that the brightness of the leaf is due to its thinness which is very undesirable. These types seemed only to increase the incidence of diseases like powdery mildew and pests like aphids. Even in pure crops of Harrison Special and Chatham, mixtures as well as natural hybrids with the above types, some of the latter resembling morphologically the H. S. and Chatham, occur in varying proportions. For this reason steps were necessary firstly to discourage the growth of the abovementioned types by

themselves and replace the seed of the nurserymen and growers continuously at least for some years by supplying pure seed of Harrison Special and Chatham.

He then proceeded to describe how pure seed was being collected and processed at the Institute. For facilitating the removal of mixtures and offtypes, the typical characteristics of the varieties as well as the undesirable types which could be observed at various stages—from the seedling stage upto harvest—had been listed. Diseased plants as well as plants suspected to be of lower quality were excluded. Rogueing for the above purpose was done 3 to 4 times. The dried capsules collected were threshed and the seed preserved in drums after removal of chaff by fanning. Then the seed was treated with silver nitrate solution to prevent seed borne diseases. Only heavy seed was collected, shade-dried first and then sun-dried and packed and the percentage of germination tested which usually varied from 98 to 100. Seed was then put in alkathene bags and packed in 1 lb. cardboard cartons bearing the name of the variety, source, percentage of germination and some essential instructions to be followed by the growers.

Discussion followed, in which Dr. Reddy emphasised the necessity of eliminating varieties like Puteha and Karedu, which, in his opinion, were occupying a fairly large area particularly in the saline type of lands. He also pointed out that there was a danger of mixtures from farmyard manure since some of the growers put tobacco stalks or trash from flower-heads collected for seed, in the manure pits.

Seminar on some key points explaining varietal behaviour in flue-cured tobacco

A Seminar on the above subject was held on 12th August, 1957 when Shri B. Radhakrishnamurthy, Plant Breeding Assistant, was the main speaker. Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee presided. Dr. N. S. Reddy of the Indian Leaf Tobacco Development Co., Ltd., and his colleagues attended the Seminar.

Introducing the subject for discussion, Dr. N. R. Bhat, Director, Tobacco Research, observed that the urgent problems for research in our flue-cured varieties were how to increase the yield as well as the percentage of bright grades. Cultural methods which promised to achieve the objectives were on trial and had given hopeful indications. Improved types which were introduced as well as bred at the Institute were also under trial. The variety Delcrest which was included in large scale trials for the first time had presented certain interesting features. It was the intention of Shri Radhakrishnamurthy to explain these features.

Shri Radhakrishnamurthy explained the performance of different varieties in the varietal trials conducted in 1955-56 and 1956-57 and presented the data with regard to the yield of green leaf, bright leaf, total bright leaf equivalent, number of leaves picked per plant, average size of leaf, the proportion of bright leaf obtained in different pickings, proportion of medium grade leaf to bright leaf, number of days taken for flowering, proportion of panicle to the entire plant, response to topping, etc. Between Harrison Special and Chatham, it was noticed that the major outturn of bright leaf in the case of Harrison Special was from the first 2 to 3 primings, whereas in the case of Chatham it came from the 3rd priming onwards. Moreover, Harrison Special gave a higher proportion of medium grade

leaf than Chatham. It was thus clear for the first time why the two varieties differed in their performance at different places and in different seasons. The special features of Delcrest had been found that in spite of its cured yield being more or less equal to that of Harrison Special and Chatham, it gave much more bright leaf. This was on account of the high proportion of bright grades that it gave. More important still was the fact that the proportion was more or less even in most of the pickings excepting the last, while in all other varieties it was very variable in different pickings. Delcrest was also found to give a high response to topping. This was very probably due to the fact that it was earlier flowering by a fortnight and, therefore, remained in the field after topping for an equivalent period. The removal of its larger sized panicle must have also contributed appreciably to the response. The number of leaves picked from Delcrest were 4 to 5 less than in the case of Harrison Special or Chatham; yet the total cured leaf it gave was slightly more than the latter varieties. Since the leaf size did not differ very much between the three varieties, it would mean that the leaves were heavier bodied as was found on visual inspection. The high proportion of its bright leaf was confirmed also in the trial conducted at Guntur. Thus, at least preliminarily, the variety appeared to be promising. The variety Hicks was also somewhat promising from the point of yield of bright leaf and the uniformity of outturn thereof in the various pickings.

Dr. N. S. Reddy said, that so far he had better impressions about Hicks than Delcrest; but from the data presented he was no doubt impressed with the performance of Delcrest. His impression was that when new varieties were introduced from abroad, their

Seminar on some key points explaining varietal behaviour in flue-cured tobacco

performance was usually satisfactory at the beginning, but was not kept up later on, and therefore, there was need for confirmation. He felt that even Virginia Gold might be considered a good variety. Dr. Bhat disagreed and said that though the performance of Virginia Gold was of a high order from the point of bright leaf at the Institute's farm and even in Southern Rhodesia where it topped the list of varieties under trial in respect of yield as well as grade-index, it was not liked in the British market, where according to his information narrow leaved varieties were preferred for quality. Delerest being of the latter type, was in good demand, and for that reason it occupied 20 per cent of the total area under flue-cured tobacco in Southern Rhodesia. For the above reasons, if the variety kept up its performance in future trials, it should prove a good substitute for Harrison Special in our country.

Shri A. S. Sastry, Chemist, pointed out that topping in different varieties had to be done leaving the same number of leaves on the plant to get a correct comparison of their performances. Dr. Bhat replied, that

the topping had been done as it should be done by the farmer in cultivating the varieties and comparison was made from a practical point of view.

Concluding the discussion Dr. Patel said, that though so far we had been attaching a good deal of importance to the grades for colour a gradual shift was being observed towards utilisation of other grades for other factors of quality as well. Development in the manufacture of filter-tipped cigarettes in a greater proportion in the world and the public preference has a definite bearing on use of tobacco. This trend deserved to be watched in further breeding work.

He expressed satisfaction at the useful way in which seminars were conducted and proposed to give a list of persons who were main speakers in seminars, in the Indian Tobacco by way of encouragement and stated that a catalogue giving details of various varieties tried, their performances etc., if prepared, will give valuable data.

With a vote of thanks by the Secretary of the Seminar Group, the seminar concluded.

Expert Committee on Tobacco

(Continued from page 269)

5. The Committee was, by a separate reference from the Central Board of Revenue requested to examine the question of losses occurring in tobacco under bond and to advise Government on this matter. The Committee has recommended that experimental data to ascertain the normal degree of losses should be collected in a fuller and more uniform way and that all factors contributing to the loss should be given due weight while deciding loss cases.

6. Government have accepted the Committees' recommendation regarding of classification of non-flue-cured unmanufactured tobacco for purposes of assessment and have implemented it in the Finance (No. 2) Bill, 1957.

7. Government have also generally accepted all the Committees' recommendations for improving control over growing and curing of tobacco. Augmentation of staff will, however, be considered in the light of Governments' efforts to rationalise the administrative machinery by setting up MULTIPLE OFFICER RANGES which is in hand and which aims at reduction of clerical and unproductive work of the field staff.

8. Government have also generally accepted the Committees' other recommendations but have reserved their decision on the question of dealing with losses occurring in bond till they have had time to collect more data and to examine the matter more fully.

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SEASONAL OPERATIONS FOR THE
MONTHS OF JANUARY—MARCH

(Received from Central Tobacco Research Institute, Rajahmundry)

In the late planted fields interculturings and weeding are to be continued as and when found necessary even in January. Removal of Orobanche and precautions against powdery mildew disease are to be continued. In January, generally, mosaic and leaf curl affected plants are noticed. These diseases are caused by virus and no curative measures are known so far. Hence, precautionary measures are to be followed for the prevention of these diseases. Mosaic disease (*Seetaphalapu tegulu*) can be easily identified by the mosaic pattern on the leaf. In doubtful cases, the suspected leaf, if held against the sun, the mosaic pattern can easily be seen. This disease spreads by contact. If healthy plant is touched after touching a diseased plant the disease spreads to the healthy plant also. In the early stages the disease can easily be spread as during interculturing, the bullocks and implements will come in contact with both healthy and diseased plants. During weeding and hoeing and again during topping and harvesting the labourers will come in contact with the plants. Hence, there is every possibility for the quick spread of this disease, if the diseased plants are not promptly removed from the field as and when noticed. The removed plants should either be burned or buried to avoid contact with healthy plants. Further, after handling such diseased plants, the hands should be cleaned with soap and running water before touching healthy plants.

Leaf curl is also caused by virus and it is spread by small white insects known as white flies. These flies suck the juice from the leaves. After sucking the juice from a diseased leaf if the insect goes to the

healthy leaf it also develops the disease. It can easily be identified as the diseased leaves are curled and deformed. There is also no known remedy for this disease. It can be prevented by promptly removing all the diseased plants as and when they are noticed. Leaves affected by mosaic or leaf curl disease perish during curing, hence it is a waste to cure them. If they are not promptly removed there is every danger of these diseases spreading to the neighbouring healthy plants.

Powdery mildew (*Challa* or *Boodida tegulu*) may also come during January particularly in fields (1) planted too close or (2) where the vegetative growth is too good either due to irrigation or excessive fertility of the field or due to both, or (3) in the low-lying areas or tank beds where humidity is more. This disease can easily be identified as the affected leaves have powdery mildew growth first on the lower and later on, on the upper surface of leaf as if some white ash has been sprinkled on the leaves and from this symptom it derives the common name 'Ash disease'. It spreads from the bottom leaves to the top leaves. The affected leaves are lifeless and perish during curing. As stated earlier the disease can be controlled by applying 40 lbs. of powdered sulphur to the soil between rows of plants, six weeks after planting or as soon as the disease is noticed whichever is earlier. If at any place cloudy weather is known to prevail for a long time soon after planting it is preferable to apply the sulphur soon after planting. At the time of application care should be taken to see that no sulphur falls on the leaves. In fields where

Seasonal Operations for the months of January—March

this disease is commonly prevalent, its spread can be minimised by increasing the distance between the plants to about 36" either way. Good field sanitation like frequent removal of weeds, dried sand leaves which generally harbour the spores of this disease, will help in considerably minimising the disease. If the disease appears, its spread can be controlled to some extent by removing all the affected leaves and destroying them. These affected leaves are any way useless for curing and if they are not removed in time, the disease may spread to the higher leaves of the same plants and to the neighbouring plants. It should be followed by application of sulphur if it has not already been done. There are some indications that topping reduces the incidence of ash disease. This may be due to the fact that leaves become thick, heavy and more bodied by topping and such leaves may resist the attack of the disease to some extent. There is also a little evidence to show that this disease may spread more quickly in irrigated fields where the humidity is more.

There are various types of leaf spots which appear on tobacco leaf. The one that is most prevalent on flue-cured tobacco in Andhra Pradesh is what is called the 'Frog Eye' (*Chukka tegulu*). This disease which is more common in the nursery is also occasionally met with in the field, particularly if there are frequent rains or if the crop is irrigated. It may be because that under these conditions, enough humidity is available for the multiplication and spread of the fungus. These visible spots from affected leaves enlarge during curing and reduce the quality of the leaf. The higher leaves from affected plants which apparently look normal might have already had the infection but did not produce the visible symptoms yet. Such leaves show up the spots during curing and this is sometimes called the barn spot. In severe cases it is advisable to remove and destroy all the affected leaves to prevent the spread of the disease and to reduce the number of irrigations, if they are being given.

Generally aphids are not a serious pest of flue-cured tobacco but during last season, their attack was severe. Spraying of different insecticides like Basudin, Parathyon, Nicotix, etc. have given immediate relief and have not been known to leave deleterious residual effect on the leaf. Nicotine sulphate can also be sprayed for their control but this chemical is too costly at present and may not be economical for large scale usage. Frequent spraying with tobacco decoction will also control the aphids but in using tobacco decoction there is a possibility of introducing mosaic disease as some of the scrap tobacco used for making the decoction might have had the mosaic disease. Hence it is not generally advisable to use tobacco decoction for flue-cured tobacco.

Removal of Orobanche should be continued as soon as it appears above the ground and definitely before it flowers and sets seed.

During these months the soil moisture will be low and it may be advisable to give a light irrigation to accelerate the growth and boost up the yield of a late planted crop, if facilities exist. Soon after the soil comes into condition after irrigation, hand hoeing should be done as otherwise, the soil cracks deeply and exposes the root system. If an irrigation is needed for flue-cured tobacco, it should be given as early as possible, any way within six weeks after planting. Late irrigation tends to interfere with normal maturity of the leaf.

The crop planted during the normal period will come to flowering and be ready for the first picking by the end of January or beginning of February. Generally, the first flowering corresponds with the first picking. In fields which are known to give papery leaf, the plants may be topped after a few flowers appear on the flower-head. The level of topping should depend on the vigour of the plant. In a vigorous plant, the topping should be higher and the reverse in the case of weaker plants. In general, it is worthwhile topping at a

level suitable to remove 3-4 top leaves which usually go into low grades. The size and body of the leaves, particularly upper leaves, improve by topping and the yield increases by about 10%. Plants which are too green at the time of first priming should not, however be topped as topping will further interfere with the maturity and quality of the leaves. When the suckers appear as a result of topping, they should be regularly removed or their growth checked by applying a drop of coconut oil by means of a small brush in the topmost 5-6 leaf axils immediately after topping. Unless the suckers are suppressed or removed, the full benefits of topping will not be visible.

Harvesting, which generally commences by the end of January, continues through February and for most part of March. Harvesting and curing are the most important phases of flue-cured tobacco production. Only ripe leaves of uniform maturity should be harvested. The leaves should neither be overripe nor too green at the time of harvest as in either case the cured leaf will be of bad quality. The harvest done on contract basis results in indiscriminate harvest of undesirable and unripe leaves and therefore should be avoided. The damage to the leaves due to improper and excessive handling is another cause of loss in quality. The leaf has to be delicately handled at the time of harvest, during transport to the stringing pandal and also during stringing. It is desirable to grade the leaf before stringing into ex-ripe, ripe and unripe leaves so that at the time of loading, the unripe leaves are kept at the top and overripe leaves at the bottom tiers. Leaves of different varieties should not be loaded for curing in the same barn, if it can be helped.

It should be remembered, that while stringing, each stick should not have more than 90-100 well developed leaves which will weigh 5-6 lbs. In each bunch there should be about three leaves placed back to back, as otherwise, sponging occurs due to lack of aeration between the leaves when they are folded one over the other.

As curing is an important process in the production of good cigarette leaf, an experienced curer is necessary who can carefully handle the leaf. Improved methods of curing have been evolved at the Institute to improve the quality of the leaf as well as to cut down the fuel consumption. One of the primary considerations is the construction of the barn itself. The top ventilator should be adjustable so that the opening can be regulated. In setting the top ventilator, care should be taken to see that it settles properly when closed. The walls of the barn should not have any leakages. The doors and ventilators also should fit tightly when closed to allow minimum leakage. It is better if the doors are made of metal sheets and insulated with plywood and saw dust to avoid loss of heat. It is a common practice among the cultivators to keep the bottom ventilator either at or slightly below the ground level. They should be at least 6" to 9" above the ground level, to allow free passage of air. The size of the furnace should be commensurate with the size of the barn. The flue pipes should have a gentle upward slope commencing from the furnace for the proper distribution of heat. An experienced curer will be of much help, if engaged at the time of construction of the barn itself. The flues should be tested at the end of each curing for any leakages and should be properly pasted with mud before loading the barn. It is absolutely necessary to provide each barn with wet and dry bulb thermometers so that the necessary operations may be done more correctly. The ordinary curometers are not sensitive enough for this purpose.

An even distribution of sticks in the tiers is essential so that the circulation of air in the barn is as uniform as possible. This can be achieved by loading the barn only after the stringing is completed, to have an idea of the number of sticks available. It should be borne in mind that the barn should never be overloaded, as the loss in many cases is considerable.

A single barn should not be loaded with more than about 700 sticks.

By a suitable modification of the curing schedule, as recommended by the Institute, the coal consumption can be cut down by about 960 lbs. worth about Rs. 19 per charge and the time taken for curing can also be reduced by about a day. The quality of the leaf produced is also better. The details of the schedule are already given in our leaflet No. 5 (revised).

A normal crop will give 6-8 pickings at 4-6 days interval and on an average 20-24 curable leaves are obtained per plant. It is generally uneconomical to cure leaf which is less than 12" in length.

At the end of the curing, all the doors and ventilators are opened to bring the leaf into condition. When it is pliable the barn should be unloaded in the cool hours of early morning. The untying and bundling should be done when there is enough moisture in the leaf, if there is less moisture the leaves break during bundling and in bulking and if there is more moisture, the colour and quality of the leaf deteriorate and there may be mould growth during bulking. If the curings are delayed and prolonged till the end of March or beginning of April there may not be enough humidity available in the atmosphere by then to bring the leaf into

condition. Under such circumstances, the humidity inside the barn can be built up by spreading wet gunnies on the floor and by spraying the inside walls of the barn with water. Direct spraying on the leaf with water should not be resorted to as it deteriorates the quality.

Bulking is preferably done in a closed room with little light. During bulking all the traces of green colour particularly along the veins of the leaves, will turn to yellow thus improving the quality of the leaf. If there is more moisture in the leaf at the time of bulking, the heap is to be broken up and rebulked on alternate dates to permit great aeration and prevent mould growth.

Grading should be done in closed and well lighted room. Properly graded leaf fetches better price. At present, grading of Flue-cured Virginia Tobacco in India is based exclusively on the colour of the leaf. The graded leaf is to be uniformly pressed into bales and packed in noosed gunny covers. Any leaf having excess moisture or is damaged by mould should be removed before baling as the rotting spreads to the other leaves also. Either at the time of grading or after baling, water should not be sprayed directly on the tobacco as it results in deterioration in the quality of the leaf.

FOR CIGARETTE TOBACCO

(Received from the Cigarette Tobacco Research Sub-Station, Guntur)

Topping and Interculture :

Topping may be done only when indicated. A weak plant or a light green plant would react favourably to topping. Depending upon the vigour and colour of the plant topping may be done either low or high.

If the soil shows signs of cracking, interculture may be continued. A gorru (three tyned harrow) or guntaka (blade harrow) or alternately the gorru and guntaka may be used for interculture. Normally no need would arise for interculturing beyond generally the end of January or sometimes the middle of February.

Harvesting :

By the time the January month is touched, the crop would normally be showing signs of maturity and ripening of leaf. The first bottom few leaves about 2 to 3 in number which are termed "Sand leaves" are unfit for flue-curing purposes being papery very much deficient in body, texture, gum elasticity etc. These leaves have very little values and therefore may, as will, be removed and composted for manuring. The removal of sand leaves would also help preventing diseases and harbouring of ground beetles at the base of the plant. The removal of the leaf is also likely to initiate or hasten ripening of the normal curable leaves above placed on the plant.

The ripening or the maturity of the leaf, the stage suitable for harvest and flue-curing is indicated by a change in green to yellowish green colour or development of yellowish mottling over the leaf. In a good

crop, the yellowish green colour will appear uniformly as a wash over the entire leaf whereas in heavy crops the mottling is observed. The yellowish green leaf cures to a flashy yellow colour against the orange yellow or reddish yellow colour of the mottled leaf. The mottled appearance is also likely to occur under heavier manuring, lack of sufficient soil moisture, imperfect ploughings, hard soil, topping when not indicated, etc. The ripened leaf is harvested from the plant one by one from bottom upwards. Care should be taken that no immature leaf is harvested as otherwise the curing of the leaf would be adversely affected. As the harvest of leaf proceeds and as sufficient leaf is collected it may be carried from the field by shallow baskets or by carts to the stringing pandal. The leaf may not be placed on the ground as soil particles might stick on to the leaf to cause spots or discolouration in curing. As little handling of the leaf as possible should be done, for, if the leaf is handled many times, mechanical injuries might be caused bruising the leaf. The bruised leaf results in development of greenish discolouration in the cured leaf. In a normal crop it is better to harvest the leaf in the cool morning hours when the leaf would be sufficiently turgid to maintain sufficient humidity in the barn for proper yellowing. If the crop in a normal field is harvested in the hot afternoon hours, it would be difficult for the proper and easy yellowing of the leaf in the curing due to insufficient moisture. But in fields where the soil moisture is sufficiently higher and the leaf

having a good lot of moisture, it would be advantageous if the harvest is done in the afternoon hours so as to reduce the chances of occurrence of sponging in the barn at curing. The proper time of harvest would thus have to be decided upon according to the nature of the crop.

The common practice in vogue viz., harvest by contract labour has been known to be responsible for the production of inferior grades of leaf. The contract labour does not take sufficient care to harvest the proper leaf and handle it properly. Invariably this category of labour being unduly quick, reckless, careless and in hurry in its work, harvests leaf of all stages of maturity and shades of colour. This leaf being a mixture of different kinds will not cure uniformly and properly in the barn. It would therefore be profitable, that the system of engaging contract labour is given up and instead daily paid workers are engaged and their work supervised by the owner.

Stringing :

The leaf on reaching the stringing pandal should carefully be brought down from the cart, baskets, etc., and placed over mats, gunny cloth, tarpaulin, etc., spread on the ground. The leaf should not be heaped as bulks, but spread over in one layer erect with the butt ends touching the ground and the tips facing upwards. The leaf should then, as early as possible be strung to the sticks. The sticks should not take in more number of leaves than what it could normally hold. If the leaf is bigger in size, the leaf number per stick be reduced and if the leaf be smaller a proportionate increase may be effected. In any case it is safe that not more than about 100 leaves are strung to a stick. Similarly not more than three leaves should be put to a bunch. Sufficient space about 8" on either side of the stick should be kept vacant so as to facilitate placing the sticks over the barn racks and to avoid bruising of the leaf in adjusting and moving the sticks in the barn. At the time of stringing, the leaf may be sorted out into immature or green, properly matured or yellowish green

and overmatured or yellow lots. These lots may be strung and placed separately. As the stringing of the stick is completed the same should be carried to racks and hung pending loading into the barn later on. The usual system of heaping the sticks with the leaf one above the other on the ground in a pile compresses and injures the leaf so much that the cured leaf shows appreciable discolourations of various types, tearings etc. These defects could easily be avoided if the sticks are hung in racks prior to loading.

Curing :

Before the barn is loaded all fittings of the barn should be examined for correct operations. The flue pipes should be so adjusted that there is a uniform even rise. All the flue-pipe joints should be air tight. There should be no cracks in the pipe system, especially the furnace and the cast iron pipe. Any leakage is likely to cause fires in the barn. Similarly leakages in ventilators, main door etc., should be closed. If zinc sheeting is used for roofing ventilators main door etc., the same may be insulated, in the suitable materials; paddy husk, saw dust, old gunny cloth, are a few of the materials that would satisfactorily act as insulation material. Insulation by this means would help better utilisation of heat. Holes put across the width of the walls at the bottom ventilator level at about 3" to 4" interval all round the barn fitted with gliding frames would help easy and efficient regulation of air and heat. These holes may be operated singly either by themselves or in combination with the normal bottom ventilators. Instead of the normal top ridge ventilators, four ventilators two each on either side of the roof may be fixed up in the middle of the slopes, for better control over the circulation of air. All the four top ventilators could be operated simultaneously by means of pulley and rope arrangement. A brick fire chamber to which two leading cast iron pipes can be fixed should be built to improve greater and uniform utilisation of heat.

Fixing up of the tier beams in such a way as to allow them move in the vertical line so

as to adjust the distances between the tier level to suit the length of leaf would prove beneficial.

The loading of the barn beyond its capacity should be avoided. In a normal barn of the dimensions 16'X16'X16', the optimal loading capacity is about 650 sticks. The sticks containing green leaf should be placed in the top, the mature in the middle and the overmature in the bottom tiers of the barn. In order to facilitate free flow of air and heat and to help efficient curing there should be a gradual reduction in the number of sticks from bottom top layer of the barn.

Every effort should be made to load the barn as early as possible after the harvest, as otherwise the green leaf may lose its moisture outside and thereby prove difficult of bringing forth sufficient humidity in the barn during the yellowing period. Soon after the loading is over, all the ventilators may be closed, but a slight passage of air may be allowed through the ventilators even from the commencement of yellowing. This would help reducing the occurrence of sponging in curing later on. When about 75% of the leaf is yellowed the fixing may be commenced by operating the ventilators. Judicious handling of the ventilators together with the raising in temperature is very important at this stage. There should not be any fluctuations. The raise in temperature and the advancement of ventilation should be gradual, to suit the condition of the leaf. If the process is slowed down or delayed, sponging or browning might occur. And if it is abrupt or quick, scalding or reddening might take place. On the completion of fixing stage, the drying of the leaf may be proceeded with. The lamina is first dried by giving as much ventilation as possible along with a corresponding raise in temperature. But in this stage the wet and dry bulb thermometer kept in the barn will be found useful for operating the ventilators. If the difference between the dry and wet bulb thermometers falls below 20, the ventilators may be opened, but if it is above 20, the ventilation can be reduced. The narrower the difference the more will be the humidity in

the barn and vice versa. The operation of the barn by this method would reduce the consumption of coal appreciably. As the difference is increasing, the ventilators should be closed, completely finally and the mid rib dried. A little moistening of coal during the feeding of the furnace is likely to help even and sustained burning and thereby reduce formation of cinders. The corners of the barn should be gone through at different heights and the leaf tested for complete drying by breaking it between the fingers. It is generally in the corners that the leaf takes longer time for drying and it is for this reason that more particularly that corners should be tested. On completion of drying, the fire is removed completely from the furnace and after some time the ventilators are opened completely to allow moist air get into the barn and make the leaf a little softish. The sticks are then removed carefully from the barn and hung on the racks outside under a pandal so that moist air acts on the leaf and turns it pliable for handling. This condition generally occurs during the night hours. The sticks are removed from the leaf and the leaf in the shape of hands from each stick is arranged one over the other, layer after layer finally to make up a bulk.

Handling of cured leaf :

The bulks are periodically examined for proper condition. The leaf should be neither too wet nor there should be high temperature. The bulks are opened from time to time as and when required. In the bulks, the leaves get pressed and develop a sort of glaze or shine. The bulks should be kept in cool and dark places. They should not be exposed to light and moisture.

On satisfactory completion of bulking hands of leaf are opened up, the country twine is removed so that the leaves are separated from one another. Grading of the leaf should be done under good light conditions. No draughts of wind should be allowed inside the grading hall. In order to keep up humidity and maintain lower temperature suitable shades which do not obstruct light should be put up.

FOR HOOKAH & CHEWING TYPES OF N. TABACUM AND N. RUSTICA SPECIES

(Received from the Hookah and Chewing Tobacco Research Station, Pusa, Bihar)

Tobacco plants get matured after 3½-4 months. The harvesting should start from January in case of early planting and should be continued upto March in case of late planting. Other factors such as variety, soil type, manurial practices, weather conditions and other cultural practices, etc., also decide the stage of maturity and actual harvesting time. The harvesting should be done early in the morning by cutting the whole plant from the base with sickle or khurpi. After harvest the plants should be left in the field for four days or so for drying. After two days the plants should be turned upside down. The plants should now be brought to the curing yard consisting of a piece of land matted with green "dub" grass. The plants should be arranged in small heaps in the curing yard and left for 1-2 days. These heaps are then broken up and left for four days to dry. Larger bulks should be built now and left for four days at the end of which they should be broken up again and the plants spread out for another four days in between turning the plants after two days. This process of alternate heaping and drying and exposing the plants to dew-fall in the night should be continued upto the end of February or so till the leaves become dark brown and the stalk dull brown and dry.

In the month of March the plants are taken inside the curing shed. The leaves should now be separated from the stem along with a small piece of stalk by means of a separating knife called "Phansul". The leaves are now tied in small bundles consisting of 20-25 leaves. These bundles are tied with banana fibre and bulked in the sun for 3-4 days if some portion of the stem attached to the leaves is not completely dry, otherwise they should be heaped inside the shed itself. The bulk should be reconstructed 3 to 4 times at intervals of about a week depending upon the condition of leaves and degree of heat developed in the bulk. The leaves should then be graded according to the quality, size and blemished in the leaf.

FOR BIDI TOBACCO

(Received from the Agricultural Research Station, Nipani, Mysore State)

JANUARY :

1. The bidi tobacco plant fully matures in the month of January when the leaves turn yellow and are ready for harvest. The plants are cut at ground level and collected in one place and then kept inverted for drying.

2. The cut plants are allowed to dry for a week in the open air and then they become dry for powdering.

3. First powdering is done a week after harvest. The dried plants are scooped and the leaf lamina detached from the stalks and mid-rib carefully. The first powdering gives good quality tobacco.

4. The remaining ribs and stalks of tobacco are further dried for a week.

5. Second powdering is done when the ribs and stalks are fully dry which separates out the tobacco that still sticks to stalks and ribs. This gives second quality tobacco.

6. The ribs and stalks remaining over are collected in one place for disposal.

FEBRUARY :

1. The roots of tobacco plants are dug out, collected and removed and the land is prepared for next year's tillage.

MARCH :

1. If rains are received land is ploughed and weeds removed.

For Motihari and Jati varieties of Hookah Tobacco of N. Bengal

(Received from Wrapper & Hookah Tobacco

Research Station, Dinhata (Cooch Behar. W.B.)

I. Motihari (N. Rustica)

JANUARY :

Removal of suckers and irrigation are the important operations to be carried out during this month.

Stray plants if left untopped earlier may be topped. Continue suckering at 7-10 day's interval till priming. If the crop needs it, give light second irrigation. The sand leaves if ready for priming, commence priming. Make preparation for curing. Uproot and destroy Orobanche (Bhulki) if observed.

FEBRUARY :

Timely priming of properly matured leaves and curing are the most important operations for the Motihari growers during February. Prime only well matured leaves during morning hours, leave them singly flat in the field for sun-drying, carry them to the curing sheds after tying into bunches in the late afternoon and load in the barns the following morning. Prime only on clear sunny days. Suckering is to be continued, if required.

MARCH :

Unloading of the cured leaf, their bulking, spreading and tying of hands are the main operations for this month.

Unload the leaves when they are fully dried including the mid-ribs during early morning hours if the leaves are in condition. Allow the leaves so lowered to remain in a heap (gadi) for 2-3 weeks. Start spreading of leaves one over the other and tying

hands. Form a bulk heap of such hands and give turning after 2-3 weeks till the produce is sold.

II. Jati (N. Tabacum)

JANUARY :

Removal of suckers and irrigation, if not already given, are the two main operations of this month.

Stray plants if left untopped earlier may be topped while suckering. Continue suckering at 7-10 days interval till priming. If the crop is infested by aphids, spray tobacco decoction. Give irrigation if not already given.

FEBRUARY :

Preparation for curing and commencement of priming of tobacco are the two important operations for this month.

Start repairing etc. of the old curing sheds and get ready for commencement of curing of tobacco. Prime whatever leaves are ready for priming. Do not postpone priming of such leaves as they are liable to be damaged due to winds, rains etc. Remove the primed leaves after sun-drying to the curing sheds. It is desirable to start priming during the morning hours only on clear sunny days.

Removal of suckers and removal and destruction of Orobanche (Bhulki) are to be carried out as usual.

MARCH :

This is the month mainly for priming and curing of Jati tobacco.

Priming of matured leaves and simultaneously their curing would continue during the month. Leaves loaded from earlier priming, if now fully dried, including their mid-ribs may be lowered and formed into bulk heaps (gadi). Spreading of leaves one over the other and tying them into hands may be commenced as soon as possible. Thus, priming, curing, spreading and tying into hands of leaves would be continued till the entire crop is over. Form bulk heaps of the tobacco hands and give turning at 2-3 weeks interval till the produce is sold.

FOR WRAPPER TOBACCO

(Received from the Wrapper & Hookah Tobacco Research Station, Dinhata, West Bnegal)

JANUARY :

If the crop is not irrigated earlier, give one irrigation. Care should be taken so as to avoid damage to the leaves while giving irrigation. Afterwards the crop is allowed to grow undisturbed. However, periodical inspection of the crop is necessary to see if there is any pest or disease attacking the crop. Spray tobacco decoction against the infestation of aphids. Plants attacked with Virus diseases should be immediately uprooted and destroyed. While uprooting and destroying such diseased plants, care should be taken that the worker or the diseased plant do not touch the healthy plants. Touch the healthy plants only after thorough washing.

Make preparation for the curing. In the later part of the month some stray leaves would be ready for priming.

FEBRUARY :

This is the month for priming, stringing and curing of Cigar Wrapper leaves.

Priming:—The leaves would start maturing early during the month. Commence hand priming of individual leaves that have matured. Place them flat on gunny or in the flat baskets covered with hessian cloth. Remove the primed leaves to the stringing shed immediately without exposing them to sun unnecessarily. Prime only as much quantity of leaf which could be strung on the same day.

Stringing:—String the individual leaves on a string by inserting a thin pointed

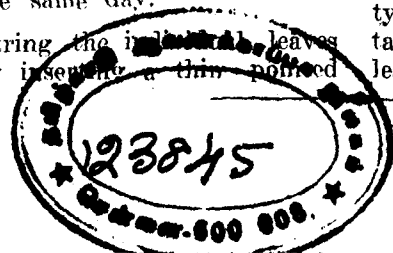
poker in the mid-rib about one inch below the butt end. Arrange the leaves face to face and back to back on the string (sutli). Keep enough space between leaves. The string ends are then securely tied on curing sticks $4\frac{1}{2}$ '-5' in length. Each stick may contain about 15-20 pairs of leaves on a string attached to it.

Curing:—Load the curing sticks having the strung leaves in the specially constructed Air curing barn. These are rested on the horizontal bamboos specially provided for the purpose in the barn. Give enough space (about 6") between two successive sticks. Allow the leaves to cure undisturbed. Maintain humidity between 70 to 80 per cent inside the barn.

MARCH :

Priming, curing and stringing would continue in this month also till the entire crop is over. Examine the leaves loaded earlier in the curing barn whether they have dried fully including their mid-ribs. Start unloading of such leaves during early morning hours when the atmosphere is sufficiently humid so that the operation could be carried out without causing any injury to the leaves. Keep the unloaded sticks on a clean floor covered with hessian or any other cloth. Examine individual leaves on the sticks and remove leaves with incompletely dried mid-ribs from the strings. Tie the fully dried leaves into hands when weather is favourable. Keep the leaves with partially dried mid-ribs for further drying.

In the handling of cigar wrapper leaves at all stages, viz., priming, stringing, curing, tying hand, etc., sufficient care should be taken so as to avoid physical damage to the leaves.



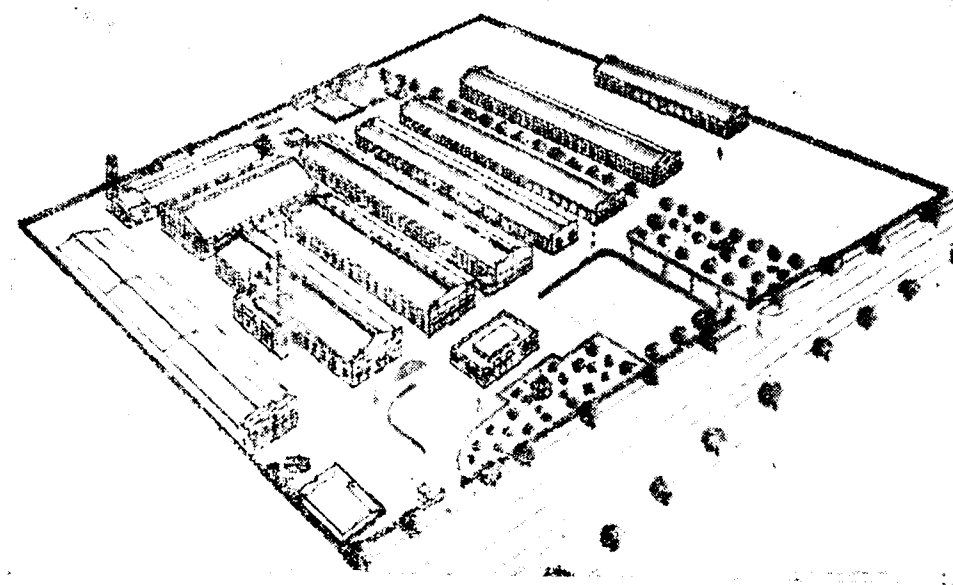
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