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Drinking water:—Add Permanganate of Potash to drinking water to give it a light red colour and change the water as often as possible; use an earthern vessel and keep it always in shade.

Give the chicks fresh grain, ground each day in the sun.

Vices. Lack of sufficient space, overcrowding, underfeeding, want of mineral matter, leaving about the weaklings which are not able to hold their own, large variations in size of the in-mates etc. are the factors which are responsible for toe-picking and cannibalism. Most of the above are easily prevented with a little attention and care. Sexes must be separated as soon as recognised.

Perching. The chicks should be perched as scon as possible They get better ventilation, there, than is obtainable when they are on the floor.

Conclusion. In conclusion, it must be stated that there is no hard and fast rule with regard to these little things and that common sense and experience alone play the most important part in the enterprise in turning out to be a success.

(To be continued)

FLUE CURING AND GRADING OF TOBACCO IN THE GUNTUR DISTRICT

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Introduction. Tobacco (*Nicotiana tabacum*) is a native of Mexico and Brazil (Watt 1908). It gained popularity all over the world by its gradual introduction and acclimatisation. The area under the crop in the Madras Presidency is 268,815 acres, of which the Guntur District contributes a third. The crop being an industrial one, is put to varied uses and i broadly classified into (a) cigar wrapper tobaccoes (b) cigar filler tobaccoes (c) pipe tobaccoes and (d) plug tobaccoes. Tobacco in the cured state is chiefly exported to the United States of America and is imported in the form of finished products like cigarettes; decoctions; active principles; medicines etc. Madras and Burma contribute their bulk quota in the export of manufactured cigars to Maldives; Straits; Ceylon and Arabia (Watt 1908.)

There are three distinct classes of persons connected with the tobacco trade viz., (1) cultivators (2) curers and (3) dealers. The present article is mainly confined to the work of the second class of people though the same embraces in a way the work done by the last-mentioned class of persons.

Of the three methods of curing tobacco, sun-curing; air-curing, and flue curing, the one mentioned last is gaining ground with the cultivators of this district as evidenced by the number of curing sheds or barns increasing every year. At present, the number is about 1400 in the Guntur District.

Flue curing is adopted for the manufacture of cigarette tobacco and the tobacco intended for cigarettes should have the following qualities :— (1) The leaves should be thin and obtained from a plant with short internodes having maximum number of leaves; (2) The leaves should be fairly broad with short veins so that the cigarette paper may not be damaged during the course of manufacture (Howard 1913) ; (3) The leaves should be light yellowish-green in colour so as to acquire a golden yellow colour on curing; (4) The leaves should not become spongy or burnt by the process of curing, but should have good texture and fine flavour. Only exotic types of tobacco like Adcock, Virginia and Harison Special are suited for the purpose, though local types grown in particular localities are used for blending.

In the Guntur taluk, there are some typical centres which produce genuine tobacco of both the local and the exotic types. These are Thadikonda, Neerkonda, Parimi, Yercapalem etc. In the above places, tobacco is raised in rotation with paddy (*Oriza Sativa*). The places are annually deposited with silt as they are subject to inundation. The crop that is intended for flue curing is allowed to flower and set seed freely. This practice facilitates the plants to produce thin leaves as the nutrition is allowed to run into the inflorescence for the development of the fertilised ovaries The local belief is that the crop will produce the desired quality of leaves if heavy rains occur when the plants commence the gummy exudation. The crop under consideration is raised only under rain-fed conditions.

Barns. The Barns of the Guntur District are of two sizes viz, (1) the full-sized ones with two stoves and (2) the half-sized ones with single furnace. The walls are constructed out of rough stone or brick, in lime-mortar or mud, as the case may be. The roof is provided with corrugated galvanised iron sheets. Except for the ventilators, the door and glass panes fixed in the walls, the rest of the portion is air tight. The inner floor space is twenty feet square with five 'rooms' and twenty-nine compartments. A 'room' is a vertical space included between two sets of tier poles extending from one side of the barn to the other. These tier poles are of Casuarina (*Casuarina equisetifolia*) and are placed about four feet and ten inches apart horizontally and two feet apart vertically. The barns are constructed in several sizes and different heights, but the one mentioned above is a typical one. The body of the barn with 400 square feet of floor space contains five rooms across and 5, 6, 7, 6 and 5 compartments to suit the ridged roof above. Starting from one side of the barn the number of compartments gradually increases till the middle room which comes just below the pitch of the roof and decrease with the slope of the roof as indicated above. Split bamboo sticks of four feet and ten inches length with the tobacco leaves hanging, are usually kept eight inches apart such that each tier will hold thirty sticks. In practice,

the number of sticks kept per each tier is much more than the desired number. The roof tiers hold about 200 to 250 sticks according to the availability of space. The entire capacity of the barn provides space for about 1100 sticks but the barn should not be over-stuffed lest it should prevent proper functioning. In times of need, instances of increasing the number of sticks up to 1,200 and 1,500 are not rare. The lowest tier upon which the green tobacco is put is about eight to nine feet from the floor. For a single charge, the produce of two and a half to three acres can be arranged in a barn of the above-mentioned specifications.

General aspects of curing. Curing of the tobacco leaf is a life process and the activity of the cells is impaired by improper manipulation. The whole process is a delicate one and requires the handling of an experienced expert. The method of doing it varies with the kind of leaf grown and the object for which it is to be used. The process of curing is very much influenced by the structure of leaf and the created artificial surroundings of temperature and moisture. The method of curing has to be regulated with the type of tobacco and no rule-of-thumb method can be given for all kinds of tobacco. The process of curing which might be best suited for cigarettes, will be detrimental for the one meant for cigar manufacture. However minute and valuable the instructions may be, for the regulation of heat at different intervals of time, they cannot as a whole be followed in practice, but require timely judgment and modification to suit the change of conditions. The rapidity of curing should be regulated, to suit the type of leaf in such a way that the delicate cells of the leaf are prevented from losing the juices which give flavour and suppleness to the cured leaves. If the process were to be taken at a rapid speed, the leaves get burnt and pole-sweated. The curing is effected by artificial heat created by burning coal in the furnace and allowing the heat to radiate through metal flues arranged as shown in (fig. 1). A thermometer is kept inside the barn so as to determine and regulate the degrees of heat required at the various stages of the curing process.

Coming to the plant it is always safe to arrange the leaves in the barn on the day of cutting, lest the leaves should become wilted. Even a difference of one day either in cutting or curing will not produce uniform colour.

Killebrew (1928) says that " curing tobacco yellow is now regarded as an art which demands the closest attention, the best judgment, and the most painstaking experience, to attain perfect results. No novice can succeed without undergoing an apprenticeship, however minute in details the instructions he may receive be."

It is always safe for any curer of tobacco leaf to watch a particular plant and thereby exercise judgment as to when to increase or decrease the heat.

According to Regland's method there are four stages in the operation of curing the tobacco leaves.

(a) The yellowing process:— Requires 90° F. of heat lasting from 24 to 30 hours.

(b) Fixing the colour:— Requires a temperature ranging from 100° to 120° for 16 to 10 hours.

(c) The curing process:— Requires a temperature of 120° to 125° for 48 hours.

(d) The curing of the stalk and stem:— Requires a gradual increase of heat by five degrees from 125° to 175° in the course of 9 to 10 hours.

Reddening or sponging of the leaves occurs during the second stage and so it is always advisable to take the process slowly and prevent the air from getting in, lest the tobacco leaf should get sweated before fixing the colour.

It is stated by Regland that approximately one pound of water must be driven out from each plant in the course of 100 hours. Under Guntur conditions it takes four to four and a half days to finish one charge according to the prevailing weather conditions.

Details of curing. The stripping of the matured tobacco leaves is usually done in the evening, and the leaves are heaped in the field. They are removed to the nearest barn the next morning, and stringed on to the bamboo stricks four feet and ten inches in length as shown in (fig. 2). During stringing the stricks are mounted on 'horses'* and two to three leaves per loop are inserted and the string is tied to the stick. A barn of the above dimensions can hold about 1,100 sticks and it requires ten to twelve coolies for stringing and arranging the sticks on the firing tiers. If the work were to be started at 6 a. m., the whole work of stringing and arranging the sticks in the barn will be completed by 3 to 5 p. m., according to the dexterity of the labourers. To get good results, the sticks are kept eight inches apart on cool days, and at ten inches apart on warm days. The fire is started at once by lighting the coal in the furnaces, and all the bottom and top ventilators are closed. The inside room temperature will be about 88° F. The temperature is then raised to 90° F. and is kept at that stage for two hours when it is raised to 95° F. and kept for ten hours. From that it is raised to 100° F. It is then the yellowing of tobacco commences. Once again the temperature is raised to 105° F. and the top ventilator is opened to half of its capacity. Gradually the temperature is increased to 115° F. and then the top ventilator is raised to the full. Simultaneously the bottom ventilators are raised by two inches from the wall. The leaves begin to sweat between 100° to 115° F. and the water contained in the leaves along with the foreign matter commence evaporating. The ventilators at the bottom are raised for allowing the cold air to get in, for half to two hours,

* A wooden frame of two vertical posts to support the sticks.

PLAN OF THE BARN

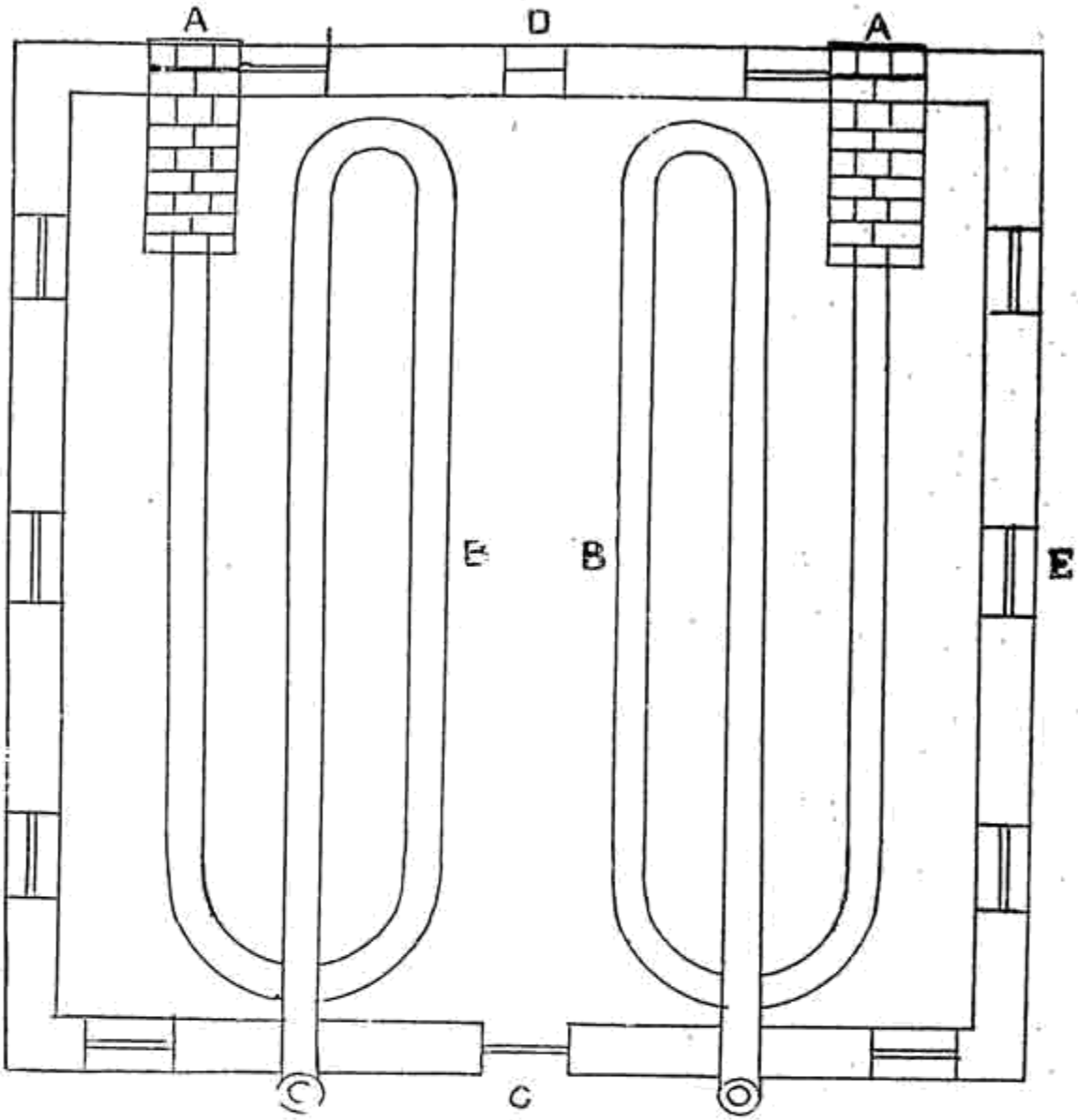

Fig. 1.

Ref :— A = Stove. B = Metal flues. C = Door.
D = Glass Pane. E = Ventilator.

METHOD OF STRINGING TOBACCO LEAVES

Fig. 2.

according to the quality of leaf, and the prevailing atmospheric conditions outside. At this stage, the leaf is watched very carefully and when it has become sufficiently yellow, dry heat is once again created and is advanced by five degrees at a pace sufficiently rapid to prevent the leaves from sponging but not so much as to splotch them. With this end in view, one has to use his experience to regulate the temperature, right along the process of curing.

By the time the temperature goes up to 135° F. all the leaves dry up, but the veins contain moisture The temperature is advanced as fast as the leaves can bear and is allowed to remain for a few hours at 135° F. This is done as a precautionary measure. When the sponging stage is passed, the temperature is raised to 140° F. and kept there for three hours. By now, the percentage of moisture contained in the leaves will be very little.

The temperature is then raised to 145° F and the shutters are lowered down to half of their full capacity. The same temperature is maintained till the leaves become completely devoid of moisture. By then, the stalks also get dried up to half of their length. The temperature is then raised to 150° F and kept so for five or six hours. It is then the side ventilators are closed completely. After maintaining the temperature at 160° F. for three hours, the top ventilator is lowered flush with the opening in the roof. For getting the veins and stalks dried, the temperature is raised to 165° F and even at that temperature, if they do not dry up, the temperature is raised to 170° F. at a time when one feels confident that the entire leaf gets dried in the course of ten hours.

The raising and lowering of temperature is manipulated by the addition of coal in the furnace, and the opening and closing of dampers and eyepieces of the stoves. When the dampers are kept open with the eyepieces closed, the outside air gets into the furnaces through the gratings and raises the temperature. On the other hand when the dampers are closed and the eyepieces are kept open, cool air gets direct into the furnaces and retards the burning of coal whereby the temperature is reduced. It takes nearly four to four and a half days to finish a charge and the coal consumed per charge works to one and a half to two tons on an average. The cured leaves are removed with the sticks, and are kept suspended under shade overnight. Early next morning they become soft when they are heaped. The heap is disturbed on the day of stuffing them, either in gunnies or dealwood cases as the case may be. If sufficient yellowing is not obtained in the process of curing, it is improved a bit during the fermentation that takes place in the heaped state. The heap should be covered and the surroundings kept cool lest the leaves should become brittle.

The salient features of flue curing are :—

(1) Leaves should be arranged in the barn and the coal in the furnaces lit before the leaves get wilted.

(2) The bends of the flues should be gradual and well curved instead of their being abrupt or bent at right angles, for the free circulation of heat and smoke

(3) For proper functioning, barns should not be overstuffed.

(4) In general, raising of temperature should be well regulated instead of too rapidly.

(5) Planks should be suspended over main flues in order to keep off the evil effects of direct heat and to prevent the scalding of the tobacco leaf kept on the lowest tiers.

(6) For sweating the entire produce in the barn, pans filled with water should be kept on the main flues for supplying warm vapour.

(7) Letting in air at the time of yellowing should be checked lest the leaf should sweat before complete drying.

(8) For regulating the temperature only one particular plant should be watched instead of seeing random leaves.

(9) The coal used must be of good quality to raise the temperature steadily and to maintain it.

(10) The flues must be kept in a perfect plane for the uniform radiation of heat.

Grading. Grading or the assorting of cured tobacco leaves into different classes according to the quality and colour of leaf, forms the work of the dealer in the tobacco trade. Yellow tobacco is usually graded into five classes and the quality of leaf under each class is as enumerated below :—

1st Class :— Leaves with good texture and of bright golden yellow colour.

2nd Class :—Leaves of bright yellow colour with green veins.

3rd Class :—Leaves that have become spongy and the leaves with green margins of varying intensities.

4th Class :—Leaves that have become reddened and those with deep green patches.

5th Class :—Broken and spoiled leaves which are locally known as "*Gullaku*".

The local dealers of the Guntur District are of two classes viz., (1) Indian firms exporting the tobacco to foreign countries and (2) Agents of the foreign firms exporting tobacco. In years of good demand all the above mentioned five grades of tobacco leaves are purchased by the local dealers, but in other years only the first four classes of tobacco are purchased by the firms. In the Guntur District, the dealers purchase cured tobacco both in the graded and the ungraded state. In the latter case, they get the stuff graded before exporting. To get a candy of cured leaf graded, the labour of ten to twelve women coolies is required. Usually it is given on a contract rate ranging from Rs. 3 to Rs. 3-8-0 per candy. The leaves after they are graded by the ordinary coolies, pass on to the expert coolies who are known as table supervisors, who rectify the mistakes of the former in the proper assorting, and after this the leaves of different

classes are packed separately in dealwood cases for export. The prices of the graded stuff during the current year are,

	Value per lb.			*per candy of 500 lbs.*		
	Rs.	As.	Ps.	Rs.	As.	Ps.
1st Class	0	9	0	280	0	0
2nd ,,	0	7	0	220	0	0
3rd ,,	0	5	0	150	0	0
4th ,,	0	3	0	90	0	0
5th ,,	0	1	0	30	0	0

The rate for the ungraded stuff is Rs. 150 per candy.

Economics.

Balance Sheet of the tobacco cultivator:

	Rs.	As.	Ps.	Rs.	As.	Ps.
Cost of production of tobacco per acre				50	0	0
Cost of curing carting etc.				60	0	0
Value realised from one acre (i.e.) two candies of cured tobacco leaf at Rs. 150 per candy (ungraded)	300	0	0			
Difference in value				200	0	0
	300	0	0	300	0	0

Net profit realised from one acre of exotic tobacco variety.....Rs. 200.

Balance sheet of the tobacco curer:

Capital outlay:—				Rs.	As.	Ps
Cost of constructing a full-sized barn				750	0	0
Cost of furnaces, metal flues, thermometer sticks etc.				250	0	0
Total				1000	0	0
	Rs.	As.	Ps.	Rs.	As.	Ps.
Annual depreciation taking the life of a barn to be ten years				100	0	0
Interest on the capital outlay at 6% per annum				60	0	0
A single barn can have 20 charges in the season lasting for 3½ months since each charge takes 4 days for completion.						
Cost of coal for 20 charges at a rate of two tons per charge and the cost of coal being Rs. 15 per ton.				600	0	0
Labour of an experienced director on Rs. 20 per mensem to manage two barns and Rs. 12 for an attender to manage a single barn. for three and a half months.				77	0	0
Labour for stringing, arranging and removing tobacco leaves from the barn etc. for 20 charges at Rs. 12 per charge.				240	0	0
Petty repairs.				10	0	0
Erection of thatched pandal and shed for keeping cured tobacco.				50	0	0
Value realised for 20 charges at Rs. 130 per charge.	2600	0	0			
Difference amount.				1463	0	0
Total	2600	0	0	2600	0	0

Net profit per season of 3½ months (in round figures) Rs. 1400.

Of late curing yellow tobacco has become a protession for the non-Agricultural capitalist of the Guntur District and hence the number of barns is increased by hundreds every year.

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THE VALUE OF SCIENTIFIC RESEARCH TO AGRICULTURE. *

By Secretary HENRY A. WALLACE,

U. S. Department of Agriculture.

I appreciate that it is often difficult for the layman to see any earthly use in many of the things that scientists do and talk about doing. Of what value is it to you and to me, for instance, for a man to spend his time trying to discover the workings of nature? How can a man—we are inclined to say—do any thing useful unless he works directly with the things that we all can touch and see, that we know have practical utility?

Well, when confronted by questions like that, I think of men like Faraday and Mendel and some of the scientists in the employ of the Federal Government. About a hundred years ago in England Michael Faraday was what we might call an experimental philosopher. He never concerned himself with the invention of machines. His sole aim was to learn something about the workings of nature. He discovered the principle of electromagnetic induction, and if you remember your high school science, you will recall that without that discovery we would today have no means of putting electrical energy to work for us. Without Faraday, the amazing inventions of Edison and Marconi would not have been possible, and your radio and your electric lights would not exist.

And Mendel, that cloistered Moravian monk who whiled away the hours studying plants and experimenting with the cross-breeding of varieties of garden peas—of what earthly use was all that? He did it because it interested him. But was it of any use to the rest of us? I can assure you that it was, for the principles he discovered have been employed by the plant breeders of to-day in developing more productive varieties of every plant that feeds and clothes you. Scientists like Mendel and Faraday were working in what we call pure science. They were trying to discover nature's fundamental secrets, but without thought of any practical application of their discoveries. Had some overzealous administrator tried to restrict their curiosity to some specific object, or the immediate solution of some highly practical problem, we would have been deprived, in all probability, of their great discoveries.

It falls upon another group of scientists to apply these basic principles to the pressing problems of the world and turn them to practictal account. Thus most of the scientific research in Government departments is applied science. The surprising thing, however, is that even in the field of applied science far-reaching discoveries are made, often as a by-product of the immediate task.

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* (Extracted from Science, May 19, 1933)