

Farming will never be a success unless the farmer
had more voice in the disposal of
his produce—P. Morrel.

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FLUE CURING OF VIRGINIAN TOBACCO IN GUNTUR

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The Guntur District with its good retentive soil and its average rainfall of 35 inches a year is congenial for the cultivation of tobacco on a commercial scale. Tobacco is, of course, grown successfully in many parts of India, but the variety that is specially suited for the manufacture of cigarettes is raised only in the Guntur District, where it is grown on an extensive scale for export to foreign countries. Cigarettes were introduced into India about seventy years ago and have now become very popular among all classes of people from the prince down to the peasant. It was in the United States of America that the fine yellow tobaccos suited for cigarette manufacture were evolved by the application of modern scientific principles and appliances. In the earlier days, all the cigarettes used in India were those of European manufacture. Their high cost due in great part to the heavy import duties naturally led to the installation of cigarette factories in India for manufacturing them cheap. But then, these factories required a supply of raw tobacco of high quality, which could not be imported owing to the heavy taxes. It was therefore found imperative to have Virginian tobacco grown in India so as to get a sufficient and cheap supply for purposes of manufacture. For this purpose, various tracts in India were explored and finally the Guntur tract was selected as the best suited for the cultivation of cigarette tobacco on a commercial scale. As long ago as 1921, experimental cultivation of Virginian tobacco was started in this District with the aim of evolving the best methods of cultivation, curing and production of the fine yellow grades of leaf suitable for cigarettes.

Soil. Soil plays an important part in producing fine light tobacco. The soil, situation and climatic conditions of Guntur are admirably suited for the

cultivation of this crop. The whole of the tobacco producing tract of Guntur may be roughly divided into three sections, viz., one producing bright yellow quality, a second, producing dark heavy quality and a third, producing the medium coloured variety. Great care was taken to select the proper tract for this experiment. As irrigation has an adverse influence on the colour of the tobacco, it has to be raised purely as a dry crop, and this is possible only in Guntur District where highly retentive soils are found.

Manuring. Tobacco requires good manuring, but this should be done cautiously as heavy manuring affects the colour of the leaf and renders it unfit for cigarette purposes. Tobacco being a Potash feeder, potash manures are highly congenial not only to the healthy growth of the crop but also to promote the burning quality of the leaf. Nitrogenous manures must be completely avoided as nitrogen is prejudicial to the development of the quality and colour of the leaf. Great care should be exercised in the rotation of crops also, and in fields intended for tobacco, nitrogen fixing crops like pulses should be avoided as rotation crops and nitrogen feeders like cereals preferred.

Seedbeds and seedlings. Tobacco seed is extremely small in size and raising good seedlings is really an art, requiring great care and skill. The seedbeds are located in a relatively elevated part of a field, in the vicinity a small pond where rain water could be obtained for watering the seedbeds. The plot is thoroughly ploughed five or six times, levelled and then manured with well rotten cattle manure. Raised beds five inches high, one yard broad and thirty yards long are made in rows with a drainage channel one foot broad and six inches deep between successive beds to drain away the excess water. Two teaspoonfuls of seeds mixed with four Madras measures of sand are uniformly sown in two beds, i.e., sixty square yards; and this area of seedbed will supply enough seedlings to plant an acre. As soon as the seeds are sown, the seedbeds are pressed down well with the feet to make it a firm seedbed so that the tender sprouts may easily fix the first roots and grow. Then the seedbeds are regularly watered for eight or nine days so as not to allow them to get dry even for a short time. Usually on the ninth day after sowing, tender seedlings will be seen to sprout. Thereafter, the nurseries are carefully and periodically watered and in about forty-five days the seedlings will be ready for planting. The sowing is generally done by the middle of August and the seedlings will be ready for planting by the first week of October.

Planting. After preparing the field, parallel lines $2\frac{3}{4}$ to 3 feet apart are marked out lengthwise and breadthwise over it, and at the junctions of lines the tobacco seedlings are planted, generally between 4 p.m. and 6 p.m. With a pointed stick a small hole is made at each junction and a small quantity of water is poured in the hole and a seedling planted. About 5,500 seedlings go into an acre. The next morning pot watering is given and again also on the third morning. After this, no watering is done. Tobacco is planted in lines to facilitate economic bullock hoeing. As the seedlings are rather delicate, planting between 9 a.m. and 4 p.m. must be avoided. Early planting results in the production of fine long broad leaf of good colour when cured, while crops planted late in the season, i.e., by end of October or November, give short, narrow leaf of inferior colour. So, care should be taken to avoid late plantings. As already stated, the cigarette tobacco should be grown only as a dry crop. Irrigation not only kills the colour in tobacco but results in a strong leaf unsuitable for cigarette making. If rains are received in the course of growth, they tend to wash away the gum 'Nicotine' from the surface of

the leaves and enable the tobacco to get a mild flavour and to cure bright. As the soils are highly retentive, growth is not affected whether there be rain or not; and by the beginning of January, the plants become well advanced in growth. Further, mother Nature comes to the aid of the crop in December and January, when a peculiar kind of sea breeze known as 'Payara Gali' blows over the country and serves to accelerate its growth. Virginian tobacco grows to a height of 5½ feet with about twenty-two to twenty-four leaves, which may be considered to be its normal growth in this District. In the meantime, two or three hoeings and weedings are given with bullock hoes to remove the weeds and to conserve the soil moisture for the utilisation of the plants.

Topping and Suckering. By the first week of January, the plants reach their maximum growth and commence to flower, when topping operations are started. In the case of cigarette tobacco, the topping is done very high, i.e., practically at the flower head, only two or three top leaves being removed, so that about twenty-two to twenty-four leaves are allowed to develop and mature. The object of topping is to make the plant food to distribute itself among the leaves so as to produce a mild tobacco suited for cigarette making. When the plants are topped a number of side shoots known as suckers, spring up. Unless these are removed, the normal growth of the leaves is affected. 'Suckering' is therefore absolutely essential, and as fresh suckers tend to appear within a week or ten days, the same process has to be repeated two or three times.

Harvesting. Harvesting demands timely care and attention. By the beginning of February, the crop will be ready for harvest. The crop should not be allowed to over-mature since complete ripening of leaves results in a strong tobacco with bad colour, due to too much juice in the leaves. The proper stage for harvesting is when the leaves begin to turn greenish yellow in colour, and the crop should, therefore, be kept under close observation and watched.

Curing: General. There are three systems of curing tobacco yellow, for cigarette making; and they are *flue curing*, *sun curing* and *air curing*. The Flue Curing system is too costly for India, but in America where coal and timber are available in plenty, timber houses (barns) can be constructed most economically and the question of fuel also is solved, coal being available cheap. But in India, the conditions are quite different and in the experimental tract especially, i.e., Guntur District, *Flue Curing* is too costly to adopt owing to the scarcity of coal and timber. Hence in the early stages of the experiment it was found necessary to adopt a combined system of *sun and air curing*, which is not only economical, but highly favourable for the production of tobacco on a large scale for commercial purposes. The *sun and air curing* method entails the exposure of the crop in the open fields suspended on racks and if the district be subject to rainfall during the curing period, there will be no possibility of curing tobacco on an extensive scale; for, occasional rains in the curing period would necessitate the constant shifting of the stringed tobacco from the sun to the shade and *vice versa*. Such disturbance at this juncture will affect the quality and colour of tobacco. But as this district is free from rains during the curing period it is well suited for adopting this method on a large scale. The *sun and air curing* system preserves the natural flavour and develops a porosity in the leaves which enables the absorption of artificial flavourings during manufacture. Curing should not be confounded with drying. It is a life process dependent

on the activity of living cells and is influenced by the structure of the leaves and atmospheric conditions. It is a very delicate operation requiring numerous adjustments during the different stages of curing suited to the structure and kind of leaf and the nature of the atmospheric conditions. Before proceeding to the description of *flue curing* it is necessary to describe the *sun and air curing* system which was adopted from 1921 to 1928.

Sun and Air Curing. Fairly ripe leaves are removed from the plants after 4 p.m. till 6 p.m. and left in the field throughout the night so that the rigid leaf may wilt a little. Early in the morning, the leaves are collected, brought and stored in shade and stringed thinly—say about 150 to 175 leaves in a 7½ feet 5 ply jute twine. Close stringing of the leaves affects the colour and sufficient precautions should, therefore, be taken.

Yellowing process. This is a process which causes the green leaves to turn yellow. Owing to the delicate character of Virginian tobacco, the following system was adopted to obtain the colour. The stringed green tobacco is tied to a thin bamboo 9 feet long (tier pole) and these tier poles with green leaves hanging from them are placed on racks arranged closely inside the curing sheds, care being taken to avoid direct sun light as much as possible. Generally, it takes 24 hours for green leaves to turn yellow.

Drying process. When the leaves are turned yellow, the next step is to fix the colour quickly, since slow drying is apt to change the colour. For this purpose, the tobacco strings are, at this stage, immediately placed 6 inches apart on racks fixed in the open field. This sudden exposure to the sun fixes the colour very well. In about six days the leafy portion becomes well dried, but the midribs take a little over three weeks to become fully dry. During nights the racks are covered with mats to prevent the dew from affecting the colour of tobacco. The mats also afford protection from possible slight drizzles and rain during nights. In this connection, it must be noted that if any rain happens to fall while the tobacco is on open racks it completely damages the crop and renders it unfit for the market. But as already remarked, this district is free from rain during the curing period.

Bleaching process. When tobacco strings are completely dry, they are removed from the racks in the morning hours and spread on the floor so that the sun's rays may play fully on one side of the leaf and this is kept on for nearly 36 hours. Then the ropes are turned and the other side is exposed to sunlight for a further 36 hours. The rays of the sun have a wonderful effect on the tobacco leaves and contribute largely to the development of the finest yellow colour. The tobacco is, then, bulked.

Flue Curing. This is a new system by which the curing of tobacco is done in barns provided with flues. In America, where tobacco culture is highly advanced, people cure tobacco yellow only by means of flues in barns built of timber, for coal is available there in plenty for carrying on curing on a large scale. In the case of the *sun and air curing* method, though by taking great care, tobacco of the required colour can be produced, the colour is not of a permanent nature and the flavour is not so good as in the case of the product obtained by *flue curing*. For the past two or three years, attempts have been made to try flue curing at Guntur and during the last season, i.e., January to April 1929, a number of ryots including myself tried this system with much success. It is hoped that during January to April 1930 it will be more widely adopted. Timber being very costly, barns were built with bricks and chunam. Much experience and judgment are required in curing

tobacco yellow. Barns are built small in order that they may be filled quickly. Fairly ripe leaves of greenish yellow colour and uniform size are removed from the plants in the field from 4 p.m. to 6 p.m. and left in the field for the night. Early in the morning, they are collected and brought to the barn. On both sides of a tier pole (a split bamboo 5 feet long on which green leaves are suspended) about 72 to 84 leaves are suspended in lots of three alternatively on both sides of the tier pole by means of twine. About 800 of such poles are prepared and housed on racks arranged inside the house about 9 inches apart, all before 6 p.m. the same day and heat is applied at 6 p.m. The main aim in curing is to expel the sap in such a way as to get the desired colour and to prevent the loss of juices which give flavour and suppleness by improper or too rapid curing. This is accomplished by regulating the heat with great care. Heat is applied by means of a flue running inside the barn heated by coal fed from outside in a furnace. A thermometer is put inside the barn so as to determine and regulate the degree of heat at various stages of the process of curing.

Yellowing process. To start with, a temperature of 90° F is obtained and is maintained for about 24 hours. It is during this period that the tobacco turns yellow.

Fixing colour. Now the temperature is raised to 100° F and maintained between 100° F and 120° F for about 24 hours. During this period the colour is fixed. It is only at this stage one must exercise great judgment in regulating the increase and degree of heat. One should not allow the leaves to get reddish in colour or 'sponging of the leaves' as it is called.

Curing process. This takes nearly 48 hours and the temperature is maintained between 120° F and 125° F. During this process the leafy portion is cured completely.

Curing of stem. This is the last stage of flue curing. This takes generally 12 hours and a temperature of 125° F to 175° F is maintained by gradual rises of 5° every hour. Curing tobacco yellow is an art which requires the closest attention and the nicest judgment to attain perfect results. To regulate the temperature, there are ventilators on the sides of the walls, as also a door. The ridge of the roof also is provided with lifting arrangements and by operating the same free air may be let in and shut out in a moment. When the stalks and stems of the leaves are cured, paddy straw is spread on the floor of the barn and water is sprinkled on it, the door and the ventilators are opened. This is generally done during the night and early in the morning the leaves will become soft and will be in a fit condition for bulking.

Bulking. This is a very important process and must be done only by experts in the line. After the bleaching process is completed in the case of *sun and air curing* system, the dried up strings are removed and folded on a fine morning when they are rendered soft by the action of dew and cool breeze and are then bulked in an ill ventilated room. In the case of flue cured tobacco the leaves are removed from the tier poles on a fine morning when they are rendered soft and bulked. The bulks are shifted from one corner of the room to the other and the shifting depends on the moisture contents of the tobacco rope. If the bulk contains an excess of moisture it is shifted the next day, but if it is moderately soft the bulk is shifted for the first time on the third day. The second shifting is done a week after the first. The third shifting is a fortnight later. Just at this stage 2% Citric Acid is sprayed uniformly over the bulk and this preserves the aroma. Then the shifting of

the bulk is done once in a month or once for two or three months according to the moisture content of the tobacco. Generally two to three months bulking will make the leaves ready for use. Then the leaves are graded according to different shades of colour and packed in cases or pressed into export bales of 250 lbs. nett with gunny covering inlaid with mats. Such finished cases or bales are intended for sending by rail or sea for factory use. Under pressure in pressed bales and cases the tobacco develops a fine aroma and preserves it.

The Financial aspect of the Experiment. One acre of the experimental plot produces 5,000 lbs. of green leaves, which when cured gives 1,000 lbs. of dry leaves. The cost of production and curing comes to annas four per lb. of dry leaf in the case of *sun and air curing* and annas five per lb. of dry leaf in the case of *flue curing*. Sun and air cured, fine, yellow tobacco sells ordinarily at 8 annas a lb. Flue cured yellow tobacco sells at 9 annas a lb. Thus a nett profit of Rs. 250 per acre is obtained in either case. An expert with great prudence and economy and with a knowledge of local conditions can manage 40 acres in either case with a nett profit of Rs. 10,000 to his advantage per year.

Conclusion. The foregoing paragraphs are the result of experiments carried on during a period of over 7 years under very trying conditions. No other crop certainly requires as much technical knowledge to grow it to perfection as this crop and the scientific handling of Tobacco culture has only just begun to be appreciated in India. The curing of the leaves and its subsequent treatment has only just been recognised as scientific processes. The plant is easily influenced by the climate, the soil and the different methods of cultivation. Climate imparts the flavour and soil determines the texture. Every producer ought to test the variety on his farm in order to ascertain just what would give the best results both in point of quality and quantity. In each district the soil formation aided by climatic conditions, gives its own impress on the qualities of the leaf as to texture, flavour, colour and special fitness for varied uses. The ability to cultivate the plant and to cure the product in such a way as to give it the desirable qualities, is of the utmost importance to the farmer and upon his skill in accomplishing this depend his profits. As Nicotine is the active principle of tobacco it would to all appearances look as if its development to a high degree were desirable. But such is not the case. The best qualities of leaf are those that contain a small percentage of nicotine, and a large percentage indicates, on the other hand, coarseness. The different processes of curing are, therefore, essential to regulate not only the colour but also the percentage of nicotine and render the leaf mild and agreeable for cigarettes. Finally, the culture of tobacco has a bright future before it and the increased demand and consumption would in course of time lead to the opening of a large number of factories in India herself. Consequently, a large area will have to be brought under cultivation and the flue system of curing will have to be extended. As has been pointed above, if the various processes described in the foregoing pages are carefully followed all such agriculturists as may undertake this system of curing would derive considerable profits and greatly improve their economic condition.

[From the report of the Imperial Economic Botanist, incorporated in the Scientific Reports of the Agricultural Research Institute, Pusa, for the year 1928-29, it will be seen that tobacco can be successfully flue cured in India to a colour which is suitable for cigarette manufacture. Ed. *M.A.J.*]