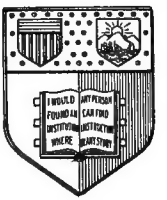

TOBACCO CULTURE

IN THE

WEST INDIES

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PUBLISED BY

AGRICULTURAL BUREAU

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HAVANA, CUBA

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INTRODUCTION

The quality of a tobacco and the price that it commands in the world's market depends upon a number of factors, some of which are known and can be controlled by the planter and others that are yet imperfectly known. The cured tobacco leaf has a fine or coarse texture, a desirable or undesirable aroma, a good or poor burning quality, a light or dark color and stained or not according to the variety, the soil, the climate, the plant food present and the curing and fermenting process.

These questions have all been studied, both from a scientific and a practical standpoint and we have tried to set forth in a concise form all that is known about the subject at the present date. The writer of this pamphlet has made a thorough study of tobacco growing in Cuba and Porto Rico and the practical methods described are those used by the more progressive planters. We take this opportunity of thanking all of the planters who have kindly furnished us data for several of the paragraphs and invite any planter to ask questions on points that are not entirely clear.

TOBACCO SOILS

There are several varieties of soil on which good grades of tobacco are produced and the tobacco from apparently different soils may often be so similar that it cannot be properly classified, even by experts. The distinctions in types cannot be judgued by the eye nor even by laboratory test but only by the class of tobacco which each soil produces.

The best tobacco soils in the West Indies are light well drained loams, that is soils containing considerable sand mixed with some clay and humus. A soil containing a great deal of clay and only a small amount of sand and gravel is not well suited for cigar filler and even soils containing moderate amounts of clay only, often produce a very coarse tobacco unless treated with large amounts of vegetable matter, such as stable manure.

The famous Vuelta Abajo tobacco grown in the Pinar del Río Province of Cuba is usually graded according to the field in which it grew and buyers make a distinction between the tobacco from each separate field. Many fields have produced tobacco for years and as the cultivation and fertilization is about the same each year the grade from year to year varies according to the climatic influences only. The land in that district is rolling and the ridges called cuchillos, (knives), are the fields producing the better grades. Not all of the ridges however, produce good tobacco, it depends on the soil formation. The soils on these ridges are generally light loam mixed with small pieces of broken rock. If this rock is a white or light colored quartz it is safe to say that the soil is some of the very best

A field ready for planting in Pinar del Rio, Cuba, with curing barns in the back ground.

for tobacco, if however, it is a red iron pebble it cannot be relied upon as a tobacco soil without first trying it.

The depressions between the ridges may be good tobacco soil but it is usually of a much heavier character than the ridges and produces and inferior grade. Many of these slightly heavy soils could be improved without much cost by growing continuous crops of leguminous plants for a number of years which would fill the soil full of humus. The same could be accomplished with stable manure but this cannot always be obtained in quantities and it is also very expensive.

The soil in which the best Cuban wrapper is grown is a clay loam containing less sand than the filler soil but rather more humus. The typical soil of this class is red in color containing no quartz rock, but usually some limestone with which it is often underlayed and therefore well drained. It is greatly improved by heavy applications of stable manure and as a matter of fact some fields could not produce a good tobacco without, because of the too heavy character of the soil.

The best tobacco soils in Porto Rico range from sandy loam to clay loam. A number of fields there produce excellent wrapper especially under shade but soil types like those producing the best filler in Cuba are not common. The soils are usually too heavy, containing too much clay in proportion to the amount of sand and humus.

CLIMATE

The influence of temperature and rainfall on the quality of tobacco is not well understood. It has been observed that plants grown in the same class of soil but in dif-

ferent localities were of very different quality even though the climate varied but slightly. It would therefore not be safe to say that a good tobacco can or cannot be grown in a certain locality without making a practical trial.

In the Pinar del Río Province in Cuba, which produces the famous Vuelta Abajo tobacco, the mean temperature for the five months, November, December, January, February and March, is about 54 Degrees Fahrenheit minimum and 86 degrees Fahrenheit maximum. To insure a good crop the rainfall should be about 3 inches per month for the five months, but it is often much less and the result is a short crop.

In Porto Rico, the tobacco districts are in the mountains and the rainfall is usually sufficient for a full crop, being about 4 inches per month.

SEED SELECTION

The foudation of the tobacco plant is the seed. A good seed may produce a poor tobacco if the conditions are favorable but a poor seed will never produce a good tobacco even if the conditions are ideal. The method commonly used of gathering the seed from left over suckers is ruinous, and if kept up for a number of years, the grade of the tobacco will deteriorate in spite of all other precautions taken. In the West Indies where usually only one variety is grown there need be no fear of intermixing with other varieties and it is not the purity about which there is any question, but the seeds from an inferior plant will produce an inferior plant hence nothing should be used but seeds from the very choicest plants. An ideal method is to go through the field before the plants are topped and

Desirable type. Note well formed leaves close together.

mark those with the most desirable leaves which should be left untopped. After the flower buds appear and before the flowers expand paper sacks should be tied over these untopped plants to prevent insects from entering the flowers. The paper sacks should be adjusted every few days to allow room for the flowers to develop.

Besides the difference in the seed from the different plants there is also a difference in the seed from the same plant. Those from the largest and well ripened pods are very superior and when separating the seeds from the capsules two grades may be had by shaking out all of the seeds that fall out readily, which are always larger and better ripened than those that adhere closely. It is also well to cut off and thown away all the smaller pods and the imperfectly developed ones of the lower cluster. A good clean seed will run about five million to the pound and it will take from forty to fifty plants to produce that amount. A clean seed can be kept without deteriorating as well as one containing chaff, by drying it thoroughly and filling into tin cans — kerosene cans are very good — which should then be soldered up and kept in a cool place until seeding time.

Seed cleaning machines can now be obtained and it is well recognized that the use of first class clean seed is one of the necessary steps to improved cultivation.

THE SEED BED

At the present time the tobacco seedlings are far too expensive, no matter if home-grown or bought. The primitive method of making seed-beds on newly cleared and burned-over land is antedated; it gave better results than

the seed-beds on old cultivated land, but it was very wasteful and not at all satisfactory.

It is seldom that conditions are favorable for seed-bed making in the tropics and tobacco seed-beds are especially difficult to handle. The tobacco seed is very small, therefore the soil in the seed-bed must be very mellow and fine. The plants after germinating are weak and easily choked by weeds, therefore the soil must be free from weed seeds. The small tobacco plant is also subject to the attack of a fungus disease, causing a decay of the stem, which is very troublesome and causes more loss than is generally recognized. Therefore the soil must be sterilized in order to free it from this pest.

The mountain or brush land filled the requirements for seed-beds, because after having been burned over it was mellow on the top. As it was virgin it was fairly fertile, and as the burning had killed the weed-seeds as well as the fungi in the soil it was clean and sterile.

In Cuba, seed-beds are frequently made on old land which is fertilized heavily with commercial fertilizer immediately before sowing the seed. The fertilizer is as a rule not worked into the soil, as it is said to give best results when left on the surface. The reason for this is undoubtedly the sterilizing effect, although this has not been conclusively proved.

HOW TO MAKE A SEED BED

The main things to guard against are: drought, heavy rains and damping-off. Therefore the land must be subject to irrigation, it must be covered to break the force of heavy rains and the soil must be sterilized to clean it from all fungus.

BEDDING

Select land in or near the tobacco field, which is well drained and free from noxious weeds, such as Pará, Bermuda or nut grass. Plow and harrow the land until it is fine and mellow, lay off the beds three feet wide with a one foot furrow between. The furrows do not need to be over six inches deep, but they must be even in the bottom and conform to the fall of the land so as to carry off all the water from heavy rains and also to be suitable for irrigation. In watering, it is common practice to sprinkle water on the top of the seed-beds, but it is far better to irrigate in the furrow and let the water remain until the beds are soaked throughly.

FERTILIZING

Apply a commercial fertilizer at the rate of 1,000 pounds per acre containing 8 % potash, 8 % phosphoric acid and 4 % nitrogen. Mix this with the upper four inches of surface soil and with a garden rake remove all the straw and undecayed organic matter, which might serve as a breeding place for fungi, after which leave the bed lay for from two to three weeks.

The amount of fertilizer here recomended is at present used on many seed-beds in Cuba, and as high as 2000 pounds per acre would probably pay, because a seed-bed must first of all things be fertile.

The formula 4 - 8 - 8 is one well suited for tobacco seedlings. The nitrogen is the element most necessary but it has been proved that with a high nitrogen content and a low potash and phosphoric acid content the plants grow

long, spindling and too soft for transplanting. A high potash content makes the plants stocky and hardy for transplanting. The nitrogen should be in a readily available form.

COVERING

For protection against heavy rains and hot sun the following method of covering is practicable and quite satisfactory: Drive stakes in the edges of the bed, about 20 feet apart, leave the stakes ten inches out of the ground and stretch a wire and clamp it to the top of the stakes. Also drive stakes into the middle of the bed leaving them 36 inches out of the ground. Over these wires stretch two layers of ordinary plant cloth, old cloth will do, and secure the edges to lower wires with small nails, used like pins. If this is stretched well, it will shed most of the water in heavy showers and still let enough water through when sprinkling with a hose or watering pot. This covering should be partly removed in the morning and evening and during cloudy wet weather to prevent the plants from growing too spindling and it should be entirely removed as soon as the plants are large enough to withstand heavy rains.

STERILIZING

This is a process entirely new to most planters although it is nothing more than what is done in the old method of seed-bed making when burning wood on the surface. It is not always necessary but it is absolutely the only way in which the planter can be sure of obtaining a suply of plants.

Sterilizing is for the purpose of killing the fungi, which on hot, damp days may destroy whole acres of seed-bed.

There are three distinct methods of sterilizing viz: hot water, dry heat and chemicals, none of which have been brought to perfection yet, but doubtless within a short time some form of sterilization will be universally used.

The water treatment consists of sprinkling the soil with boiling water so as to wet it to a depth of 2 inches, and in order to make the effect doubly secure it should be gone over in this way twice. The soil should not be stirred again before sowing the seed as that would spoil the effect, bringing some of the unsterilized soil, from deeper down, to the surface.

Of chemicals, formaline has been used successfully at the rate of 4 pounds per 100 gallons of water. With this mixture the soil should be sprinkled just as with hot water.

The dry heat method, which has been used for years where brush was burned on the land, is not practicable on a large scale but with improved machinery, using alcohol or gasoline as fuel, this method will probably be the most pratical.

SEEDING

Tobacco seed is generally sown by hand and the results is invariably an uneven stand and usually from five to ten times more plants than the bed can accommodate. In order to produce a good stocky seedling each plant should have a space of one square inch and to accomplish this the seed should be sown in drills one inch apart, sowing it very thin, either by hand or by machine. As the seed is very small it should not be covered but the soil should be ligthly firmed with a roller or a board.

Weeding should not be necessary in a seed-bed, but often the land is more weedy than it ought to be and it becomes necessary to weed by hand.

Thinning-out is practically unknown in tobacco seed-beds, but it is very good practice to remove surplus plants and leave more room for the remaining ones. If the seed is sown in drills it is almost possible to thin out to one plant per square inch by using a steel rake with broad teeth one inch apart and drag it across the bed. This takes out most of the surplus plants and saves a great deal of hand labor.

With one plant per square inch, one acre of beds three feet wide and one foot apart will contain 4,704,930 plants or for practicable purposes four and one half million.

SEED BED ENEMIES

If the soil has been sterilized, there will be but little trouble afterwards, but without this the loss from fungi is almost sure to be heavy. This loss occurs principally while the plants are just appearing and can often be checked by spraying with (1) Bordeaux Mixture.

(1) **How to make Bordeaux Mixture.** — Dissolve 6 pounds of copper sulphate in 25 gallons of water. Slake 6 pounds of good stone lime in a small amount of water and strain out all lumps and grit. Then pour the copper sulphate solution and the lime water simultaneously into a 50 gallon barrel while stirring briskly. This mixture should be used within a few hours after mixing. If the lime is not fresh and partly air slaked more may be required and it is safest to test the mixture. Take one oz. ferrocyanid of potassium (a very poisonous substance which must be handled with care) and dissolve it in 5 ounces of water. Take a little of the Bordeaux Mixture in a glass and add a drop of the ferrocyanid solution. If the drop makes a yellow spot where it falls the mixture is all right whereas if it makes a brick red spot more lime must be added.

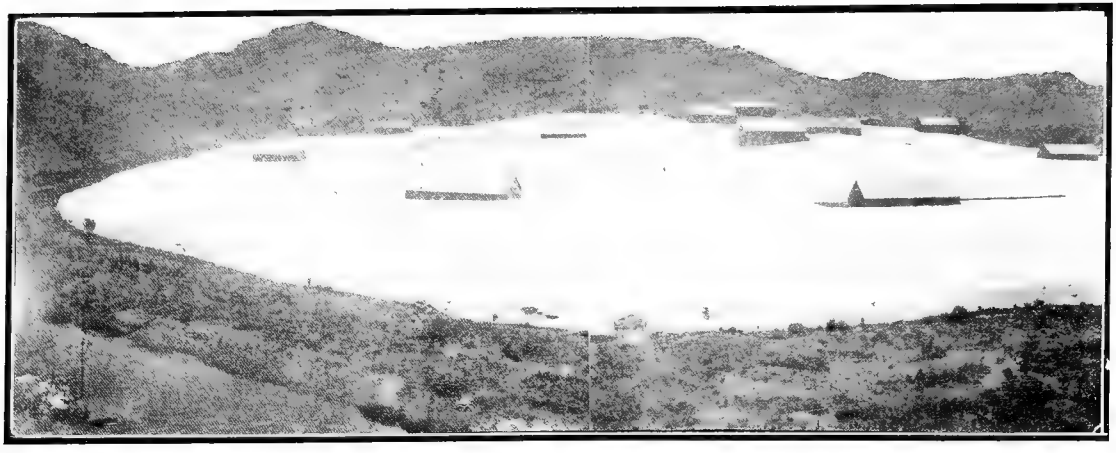
The small seedlings are subject to the attack of a very small insect, (a flea beetle), for which they should be sprayed with a mixture of one pound of arsenate of lead to 15 gallons of water. The same remedy may be used successfully for catterpillars and is preferable to Paris Green.

SHADE

The importance of cloth shade for tobacco fields is universally recognized. The value of a wrapper leaf is in its size, texture and freedom from blemishes, and shade grown tobacco possesses these merits much more than the tobacco grown in the open, but the flavor is less desirable and the filler leaves from a shaded field are worth less than if no shade had been used. The shade consists of a cloth, known as tobacco cloth, stretched over wires supported by wooden posts set in the ground. The method of erecting this structure varies, but one of the best that we have seen was at Pinar del Río and the owner furnished us with the following data regarding material necessary for a shed covering ten acres:

1,870 posts 9 feet long (2×4 or 3×4 or round native posts).
200 Hard wood stakes or stone deadmen.
3,000 lineal feet of boards 1¼ inch × 4 inches.
3,000 „ „ „ „ 1 „ × 6 „
(1) 3,000 pounds No. 10 soft galvanized wire.
(1) 50,000 square yard of cloth.

(1) In Cuba wire costs about $4.50 per 100 lbs. and cloth 3 sents per square yard.



Field under cover, Cayey, Porto Rico.

ERECTING

The shed may cover a piece of ground of irregular shape but the posts must always be placed in straight lines and at right angles.

Start by running a wire parallel with the general direction of one side of the field from end to end. At one end establish a square corner by measuring 80 feet along the wire, placing a stake at the finishing point; then from the same starting point measure off 60 feet at right angles to the wire and place another stake. The distance between these two stakes should be exactly 100 feet, if not the 60 foot stake should be moved to the 100 foot mark without varying the 60 foot distance. Then stretch the wire from the corner through the 60 foot mark and continue to the other side of the field and square that corner in the same way. The other two lines may be laid off and the corners squared off likewise. Then place posts along the wires all around the field exactly 200 inches apart, leaving them seven feet out of the ground. Next nail the $1\frac{1}{4}\times4$ strips on the upper ends of the outer rows of the posts connecting these one with another. After this stretch wires from posts to posts across the field in both directions. Set a hard wood stake or "dead man" from 10 to 12 feet outside each post and run the wires from the top of the posts down around these stakes and back to the top of the post. The wires can then be tightened at any time and as much as desired by twisting the two wires between the posts and the "dead men". After tightening the wires place the posts in the middle of the field exactly where the wires cross which will make them stand 200 inches apart each way. Staple the wires to the top of the posts with a two

inch staple, after which stretch two more wires crossing the first ones in different directions immediately on top of each post. These last wires should also be stapled which leaves each post secured by eight guy wires in as many different directions. Such a shed will stand almost any storm.

In putting on the cloth, draw it along the top of the wires, piece by piece, like a rope, but be careful to keep all the twists out of it. Sew the edges together with an ordinary cotton twine, using it double with a herring-bone stitch about three inches long. As the cloth is 200 inches wide it reaches from wire to wire and in sewing, the wire should be inclosed in the seam and the cloth in this way secured to the wire. The cloth is taken down at the end of each season and with care can be used for three seasons. After covering the top the 1×6 inch pieces are nailed on to the posts close to the ground and the sides of the shed also covered with cloth.

In the filler section cloth wind-brakes are often placed around parts of the fields to protect the plants from wind or dust if it is close to a road.

IRRIGATION

With intensive culture and especially with a high priced crop like tobacco irrigation is usually a paying investment. In the West Indies most of the water used for irrigation is obtained by pumping the underground water into tanks located high enough in relation to the field so that the water will flow to any desired point by gravitation. For driving power, wind mills may be used as the wind velocity is usually sufficient but as the capacity is limited, gasoline or alcohol engines are more practicable. An aver-

age engine will supply 100 gallons per minute for each horse power with a lift of 30 feet. That is the capacity of a 30 horse power engine would be 3000 gallons per minute with a distance of 30 feet between the water level and the top of the tank. These figures stand in proportionate relations. If the distance is doubled the capacity is halved or vice versa, so that at a 60 foot lift a 30 horse power engine would pump only 1,500 gallons and at a 90 foot lift only 1,000 gallons por minute.

Whenever the land is reasonably level and not too pervious it is practicable to water in the furrow. That is, to let the water into the furrows from the faucets and let it flow in the furrows some distance, but in many tobacco soils too much water is lost through seepage. Tobacco cannot be watered with a hose because it injures the plant to drag the hose back and forth and it is undesirable because it sprinkles dirt onto the lower leaves and injures them.

In Cuba tobacco fields are frequently watered with cans and a system of overhead sprinkling is used with good success.

PREPARING THE FIELD

Tobacco is usually grown on the same land for several years in succession and it is customary to leave the field lay without cultivation from the time of harvesting to the time of planting the next crop. This time being the rainy season, the weeds naturally grow rank and leave a great deal of vegetable matter to be plowed under. This is of great benefit because it supplies humus, which is very necessary in a tobacco soil. It would be much better however, to plant a crop of legumes for plowing under, and

the work connected with this would be amply repaid by the better qualty of tobacco and the saving of fertilizer.

Immediately after harvesting the crop the land should be plowed and cow peas, velvet beans, sword beans or some suitable legume should be planted in rows from three to four feet apart. Through the summer these legumes will entirely cover the ground and should be plowed under with a turn-plow a month or six weeks before the tobacco seedlings are ready to set out. After plowing, the land should be stirred at least once a week until planting time, because at that time of the year drought is the one thing to guard against and by stirring the surface layer the moisture in the underlying soil is prevented from escaping.

FERTILIZING

The food requirements of the tobacco plant have been known in a general way for many years but owing to the widely different purposes for which tobacco is used the general information is of no value, as a matter of fact it is in many instances harmful. We are told that nitrogen is the material to make tobacco grow, but that does not mean that it is the only thing. Schloesing found that nitrogen increased the nicotine content in the leaf and it is well known that nitrogen alone produces an abnormally rank growth and a coarse watery texture.

Phosphoric acid has never played much of a role in tobacco growing because the plant needs but a small amount of it. Nessler reports that a large amount of phosphoric acid in the soil causes the plant to take up more of it than is necessary, causing a poorer burning and a dark ash.

Potash has always been reported to be the most neces-

Tobacco five weeks from planting-not fertilized.

Tobacco five weeks from planting.—Fertilized with complete fertilizer

sary element because more of it was found in the leaf than of the other elements, but the statements made regarding the amount of potash actually necessary and the most desirable form in which to apply it were often misleading because the influence of potash was not fully known. It has been claimed by some that silicate of potash was the most desirable form and by others that carbonate of potash was the only real desirable form which claims have not been substantiated by later experiments.

To settle these points a series of extensive experiments were inaugurated by the German Agricultural Society under the direction of Prof. Dr. Wagner and the results appear in bulletin No. 138 of that Society.

NITROGEN

In regard to nitrogen Prof. Wagner tried all of the different forms, nitrate of soda, sulphate of ammonia, nitrate of ammonia, nitrate of lime and others. He found that nitrate of soda was not desirable which agrees with results obtained by others, the exact reason for this does not seem to be known but it is generally thought that the soda is detrimental to the burning quality. The influence of nitrate of lime has not been fully established but the actions of sulphate of ammonia and nitrate of ammonia were carefully compared by Prof. Wagner and he found in smoking tests that tobacco fertilized with sulphate of ammonia burned seven seconds longer than that fertilized with nitrate of ammonia, and he concludes that for the present at least it is safest to use sulphate of ammonia.

PHOSPHORIC ACID

The phosphoric acid content of the tobacco plant is so small, that this, although a most necessary plant food, is seldom considered in tobacco culture. Nevertheless it has been found by experiments in Cuba, and indicated by experiments in Porto Rico, that phosphate fertilizers have more influence on the growth of tobacco than those containing nitrogen or potash, or both. The reason for this has not been thoroughly explained; it may be that the phosphoric acid in the soils in these two islands is so insoluble that the tobacco plant cannot supply its needs even though a chemical analysis shows large phosphoric acid content but undoubtedly its action is largely indirect.

Unfortunately the experiments conducted in Cuba and Porto Rico cover a short period of time only and there is yet no published data to show the influence of phosphoric acid on the quality of tobacco. From the writer's observation and from statements of intelligent planters it appears that tobacco fertilized with large amounts of phosphoric acid or phosphate of lime burns extremely badly and produces a dark colored, flaky ash. In view of this we would recomended planters to consider carefully whether they can afford to sacrifice quality for gain in weight. It is clear that phosphoric acid must be applied but it is equally clear, from experiments conducted in nearly all civilized countries for the last forty years, that no more phosphoric acid should be applied than is necessary to actually supply the plant's need, which for cigar tobacco is less than one half of one percent of the weight of the dried plant.

POTASH

While phosphoric acid and nitrogen is needed to grow a plant it is principally potash that determines the quality of tobacco.

(x) Dr. Wagner found after many years of experimenting that the burning quality of a tobacco depends on the potash content of the leaf. He also found that the content of the leaf depends upon the amount of available potash in the soil. Tobacco grown in soils with a low potash content contained 0.51% to 0.70% potash in the dry leaf which was found to be very poor tobacco. A tobacco grown on soil well fertilized but with only a medium potash content contained 2.3 % potash in the dried leaves but that was also of poor burning quality. The best burning quality was not obtained until the potash content of the dried leaves reached 6 % and in order to reach this high percentage it was necessary to apply 900 pounds of potash per acre, equal to 1,800 pounds high grade sulphate of potash, which shows that a soil must be fairly saturated with potash in order to produce a tobacco of a high combustibility.

Many different chemical combinations of potash were used by Prof. Wagner and he disproved a great many fallacies regarding the effect of various salts on the tobacco plant. The three forms of potash: carbonate, silicate and sulphate were carefully compared. A number of experiments in differents soils and under different conditions brought out the fact that they were practically of equal value, the sulphate being rather the more desirable. This is of great importance to planters and fertilizer manufac-

(x) Bulletin 138 German Agricultural Society by Prof. Dr. P. Wagner, 1908.

turers as it settles that much disputed question of sulphate versus carbonate.

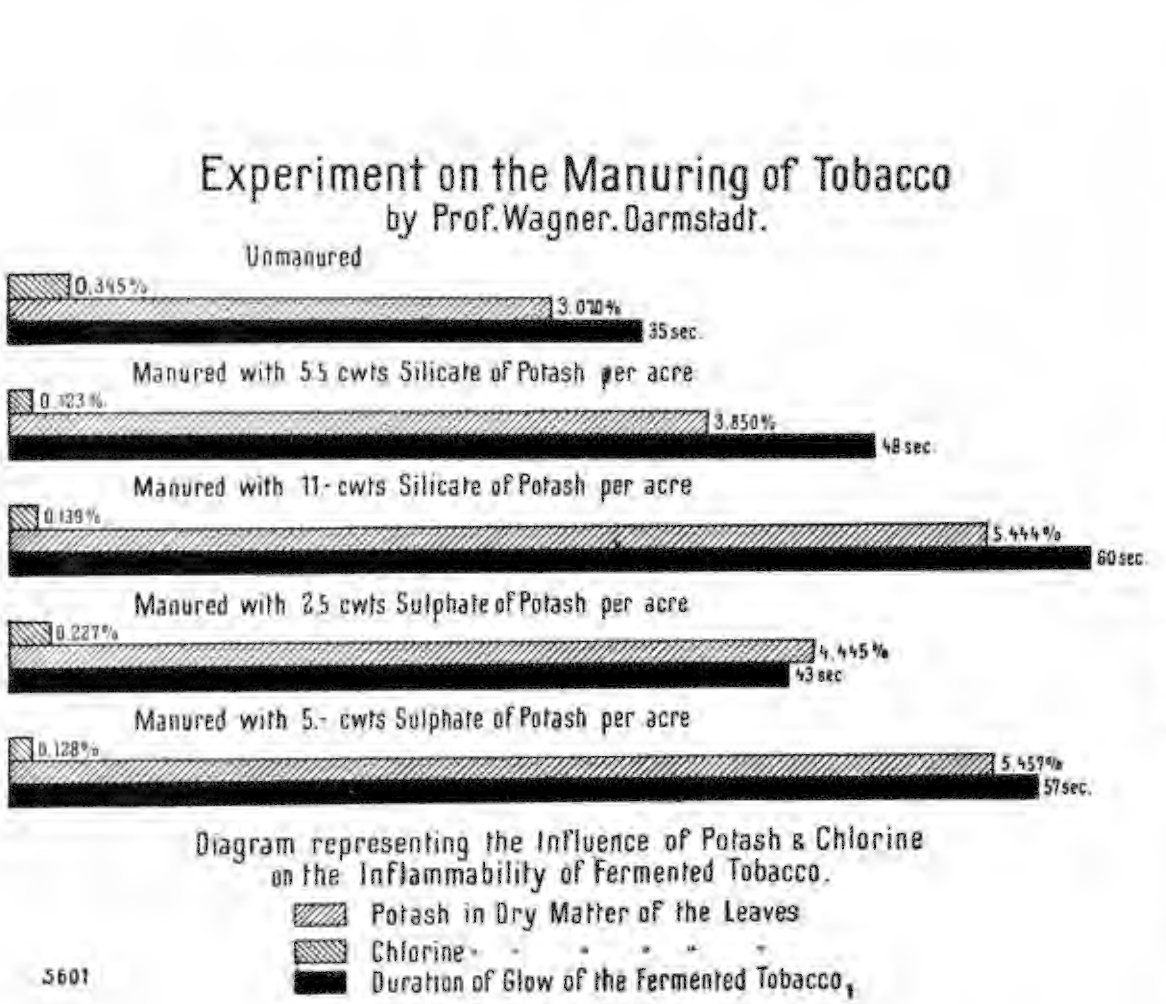
These experiments referred to, although conducted in Germany, are directly applicable to the West Indies or any other country, because they show that the quality of tobacco, especially the burning quality, is depedent mainly on the mineral content of the leaf.

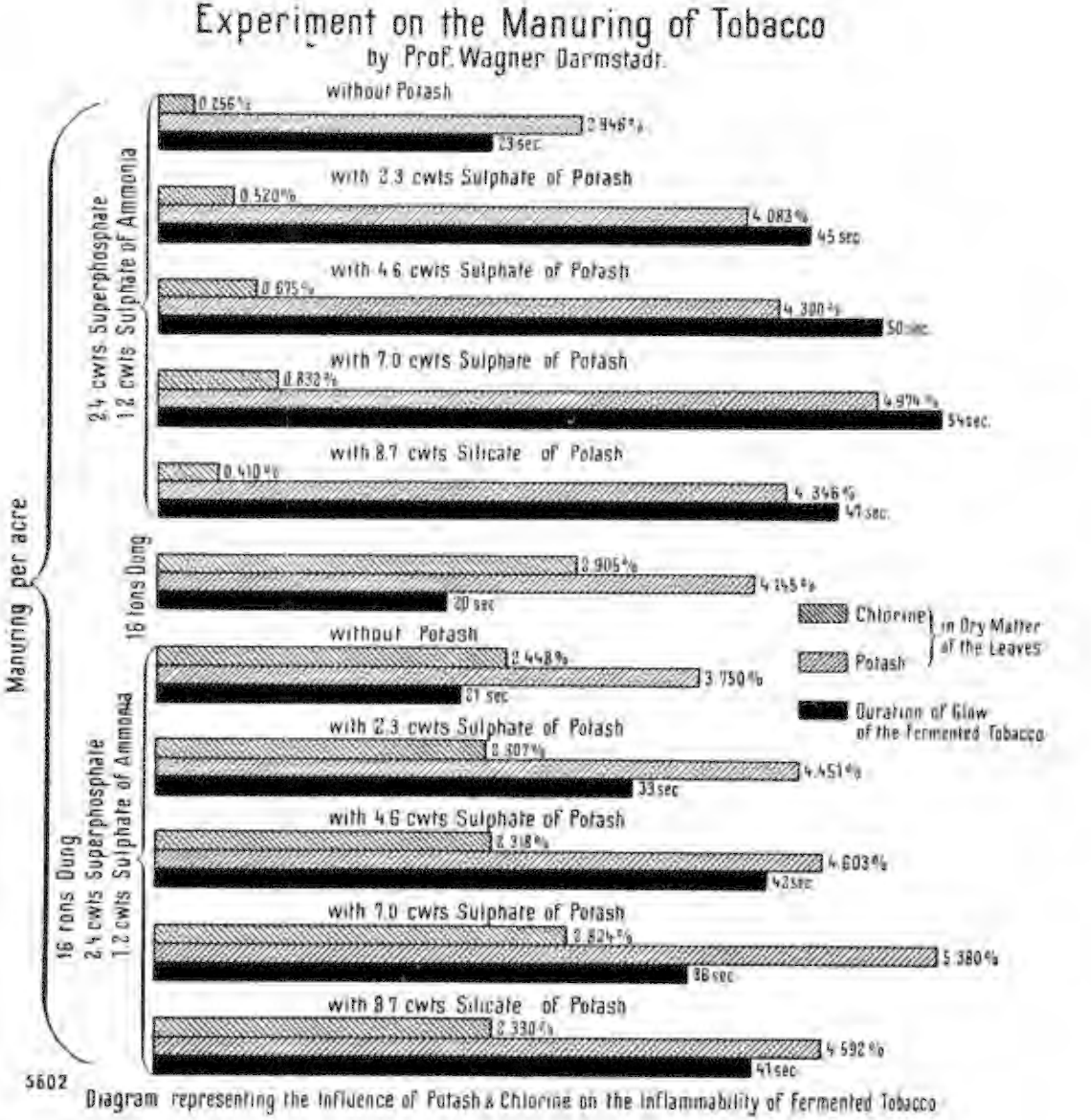
CHLORINE

Chlorine is the "bug bear" of the tobacco planter and everybody is afraid of it, which is quite right, but as the average planter's knowledge seems to be defective in regard to where chlorine comes from and how it acts, this paragraph may be of general interest.

Chlorine is usually found in combination with soda as in common salt, or with potash as in muriate of potash, or with lime as in chloride of lime and any soil or fertilizer containing high percentages of these combinations is unfit for tobacco. This is one reason why a good grade of tobacco cannot be produced close to the ocean, the sea water containing salt, (sodium chloride). Stable manure contains more or less chlorine and much damage is undoubtedly caused by large amounts of stable manure being applied immediately before planting.

Chlorine is not necessary for the tobacco plant, but if it is present in the soil in combination with plant foods, the plant will absorb it, having no other choice, and the result is always a lowering in the burning quality. Profesor Wagner showed that one half percent or less of Chlorine in the dried leaf caused no great damage, provided the potash content was high, but with a low potash content a very small increase of chlorine caused the tobacco to burn worse.





Diagrams showing the combustibility of fermented tobaccos with varying potash and chlorine content

TOBACCO ANALYSIS

Prof. Wagner obtained 19 samples of tobacco from the United Laukat Plantation Company in London and found the following plant food and chlorine content: 6.09% potash, 0.489% phosphoric acid, 3.48% nitrogen and 0.553% chlorine. Seventeen samples of Sumatra tobacco obtained from Laeser & Wolf, Tobacco dealers in Bremen, contained 6.355% potash and 0.751% chlorine. These seventeen samples, ranging in price from $25.50 to $136.00 per 100 pounds, were tested for burning quality and one sample valued at $136.00 and containing 7.173 % potash and 0.294% chlorine, had a burning duration of 128 seconds while another sample valued at $42.50 and containing 7.233% potash and 1.170 chlorine burned 116 seconds only. Showig that the high chlorine content in the latter sample lowered the burning quality and consequently the price.

Of the two other samples taken at random from the same lot, one valued at $25.50 and containing 5.26% potash and 1.735 % chlorine, burned 32 seconds only, while another valued at $123.50 and containing 8.221 % potash and 0.859 % chlorine burned 345 second.

The foregoing diagram shows the burning duration of fermented and cured tobaccos with varying potash and chlorine content.

Of Cuban tobacco, Prof Wagner reports four samples as follows:

	Price per 100 lbs.	Burning time Seconds	Potash content %	Chlorine content %
Vuelto	$ 175.00	65	3.528	1.787
Partido	,, 145.00	124	5.163	1.657
Remedios	,, 75.00	121	5.524	1.463
Yara	,, 100.00	161	5.583	2.789

This shows a low potash and high chlorine content and consequently an average burning time much shorter than in the Sumatra. Of course a tobacco is not valued by its burning quality alone and the Cuban tobacco brings a high price notwithstanding its low burning quality. There is no question, however, that a great deal of the lower price tobacco grown in Cuba would command a better price if the burning quality were better. In growing cigar tobacco the question is not how many bales an acre yields. There is no profit in tobacco measured by that standard; a bale may be worth $ 1000.00 and it may be worth $10.00 only, a difference easily brought about by proper or improper fertilizing, and while there is always a certain amount of low grade tobacco it is the bales bringing several hundred dollars each that makes it the most remunerative crop cultivated.

STABLE MANURE

It is well recognized by planters in general that stable manure is valuable as a tobacco fertilizer but it is often misused. The value of stable manure is not in the plant food content because it contains only from 10 to 12 pounds nitrogen, 5 to 10 pounds potash and the same amount of phosphoric acid per ton. This would be equal to one hundred pounds of fertilizer with formula 10 to 12 % nitrogen, 5 to 10 % potash and 5 to 10 % phosphoric acid. Such a formula is never used for tobacco and it is fortunate indeed for the tobacco planter that all the nitrogen is not immediately available for it would certainly make a very coarse and undesirable leaf.

The value of stable manure is in the organic matter

that it contains, which when incorporated with the soil, makes it loose so that the air can enter; it makes it hold moisture better and it makes the plant foods in the soil soluble.

In Cuba, stable manure is often applied to some of the heavier tobacco soils, not too far from Havana, at the rate of from 40 to 50 tons per acre. This would be impracticable and too expensive in other parts of the West Indies, but applied at that rate it changes the physical condition of the soil in a short time. Unless the soil is very heavy, such applications are neither necessary nor desirable.

The stable manure is usually dumped in the field in cart load heaps and left for days, weeks or months until spread over the soil and then usually left exposed to sun and rain for a long time before plowing under. In that way much of the plant food is lost and an overabundance is deposited in the soil immediately under and around where the heaps were dumped. The wethod has one advantage, which is not commonly recognized viz: the washing out of chlorine. All stable manure contains more or less chlorine and when applied immediately before planting, the result will be a tobacco of a lower burning quality. The best way is to apply the manure in the spring to land intended for planting the next fall.

An ordinary tobacco soil having received ten tons of stable manure per acre is well fertilized compared with many receiving commercial fertilizer because that would be equal to ½ ton of commercial fertilizer per acre with formula 10 % to 12 % nitrogen, 5 % to 10 % potash an 5 % to 10 % phosphoric acid, but as stated above, that is an undesirable formula for tobacco. To such soils an application of 200 pounds of sulphate of potash will greatly

improve the quality of the tobacco and an additional 200 pounds of acid phosphate will no doubt increase the yield without decreasing the quality.

COMMERCIAL FERTILIZERS

The main requirements for a tobacco fertilizer are as follows: (a) The potash must be present in a form not containing chlorine. High grade sulphate of potash being one of the most preferable forms. (b) The nitrogen must be in a form readily available but nitrate of soda should be used in minimum quantities only. (c) The phosphoric acid must be present in an available form, such as acid phosphate. The relative amounts of the three elements may vary according to the soil and the class of tobacco desired. In the West Indies, for a high grade filler in which aroma and burning quality determines the price, potash is the principal element and a fertilizer should contain the plant food in approximately the following order: nitrogen 1,phosphoric acid 2 and potash 3½, that is a fertilizer containing 3% nitrogen should contain 6% phosphoric acid and from 10% to 12% potash.

For wrapper tobacco, that is where the profit is to be made out of wrappers mainly, without regard to the quality of the leaves fit for filler only, the formula would be about 1 nitrogen, 2½ phosphoric acid and 3 potash. That is a fertilizer containing 3 % nitrogen should have 7 % to 8 % phosphoric acid and 9 % potash.

HOW TO APPLY FERTILIZERS

The best way is to apply the fertilizer in the furrow and mix it well with the soil from three to four weeks before

planting, but if this is not practicable and the fertilizer must be applied immediately before planting, the best method is to open furrows three feet apart by plowing one furrow to each side with a mouldboard plow, scatter the fertilizer in these furrows and mix it well with the soil by running a cultivator back and forth three to four times. This will insure a perfect root system and in this way the plant roots are not injured, which they would be by planting directly in the fertilizer. *This is very important and we wish to especially emphasize, that in order to get the full benefit from a fertilizer and not injure the roots it must be well mixed with the soil.*

HOW MUCH TO APPLY

Always apply the amount that gives the best return for the mony invested. The standard of one arroba (25 lbs.) per 1000 plants, was set by the Cuban planters years ago when guano was used and the price was more than double what it is now. That however, cannot be used as a standard any more and there is no reason why it should because it has neither a practical nor a scientific foundation. With 20,000 plants to the acre , 25 lbs. per 100 would be only 500 lbs. per acre. If this contains 3% nitrogen, 6% phosphoric acid and 10% potash the whole application would amount to 15 lbs. nitrogen, 30 lbs.phosphoric acid and 50 lbs. potash, which is far short of being a full application as shown by analysis of the tobacco leaf and stem.

Prof. Wagner found that 5800 lbs. of air dried leaves and stems contained 266 lbs. of potash and that of the 5800 lbs. 3200 lbs. were leaves. Showing that 266 lbs. of potash is necessary to produce 3200 lbs. of tobacco.

Comparing this with the standard of one arroba per 1000 plants furnishing 50 lbs. of potash per acre, we find that we will have only enough potash to produce 535 lbs. of tobacco. That is provided the plants absorb all of the fertilizer applied, which they never do. Of course the soil contains certain amounts of potash, but as it is often in a very slowly available form the plants cannot utilize much of it and in order to produce a tobacco of real fine burning quality enough potash should be applied to satisfy the need of a full crop. At least three arrobas (75 lbs.) per 1000 plants of a fertilizer containing 10 % potash, 6 % phosphoric acid and 3% nitrogen, would undoubtedly be needed in most localities.

PLANTING AND CULTIVATING

Tobacco is planted by hand, both in Cuba and Porto Rico. This is not entirely because of the hilly condition of the land, at least not in Cuba, but planting machines have not so far been introduced. The ordinary planting machine would have to be propelled by oxen at a very slow gait, because the plants are set very close together. Under shade the plants are set 8 to 12 inches apart in rows three feet apart. In the open, the distance is about ten inches between the plants according to the locality and grade of tobacco, but the distance between the rows is usually less than three feet and very seldom more than that. In planting, a furrow is opened with a native plow and the plants set in the bottom of the furrow. The plants are pulled from the seed-bed one by one and tied in bundles of one hundred. No attempt is made to save the root system nor to protect the seedlings from drying out. The bundles are

Picking wrappers.

often transported long distances and not planted for several days after removing from the seed-bed. The consequence is that the plants become dormant and do not start growth for a week or ten days after setting out and many are lost entirely. This is largely overcome by having seed-beds close to the field from which the plants may be taken up with some soil adhering to the roots.

Cultivation is usually done with the hoe although some of the more progressive planters use cultivators. While the plants are small, cultivation should certainly be done by machinery. It takes but little time to teach a mule to walk between the rows without injuring the plants and the work is very much cheaper as well as more satisfactory. Hoeing only destroys the weeds while cultivating also loosens the soil and conserves the soil moisture. The land should be kept free from grass while the plants are small so as not to necessitate working after the leaves are well developed, as every injury to the leaf reduces its value.

TOPPING AND SUCKERING

Topping consists of pinching off the extreme top bud which arrests the growth of the plant in an upward direction and throws all the strength into the leaves already developed. No explicit directions can be given for topping, because not all plants should be topped at the same height. A strong vigorous plant may be able to develop from two to three pairs of leaves more than one less vigorous, but in all cases plants should be topped before flower buds expand because the formation of flowers and seeds is detrimental to leaf growth. The flower bud should preferably be removed as soon as discernible by pinching

Newly cut wrapper leaves ready for curing.

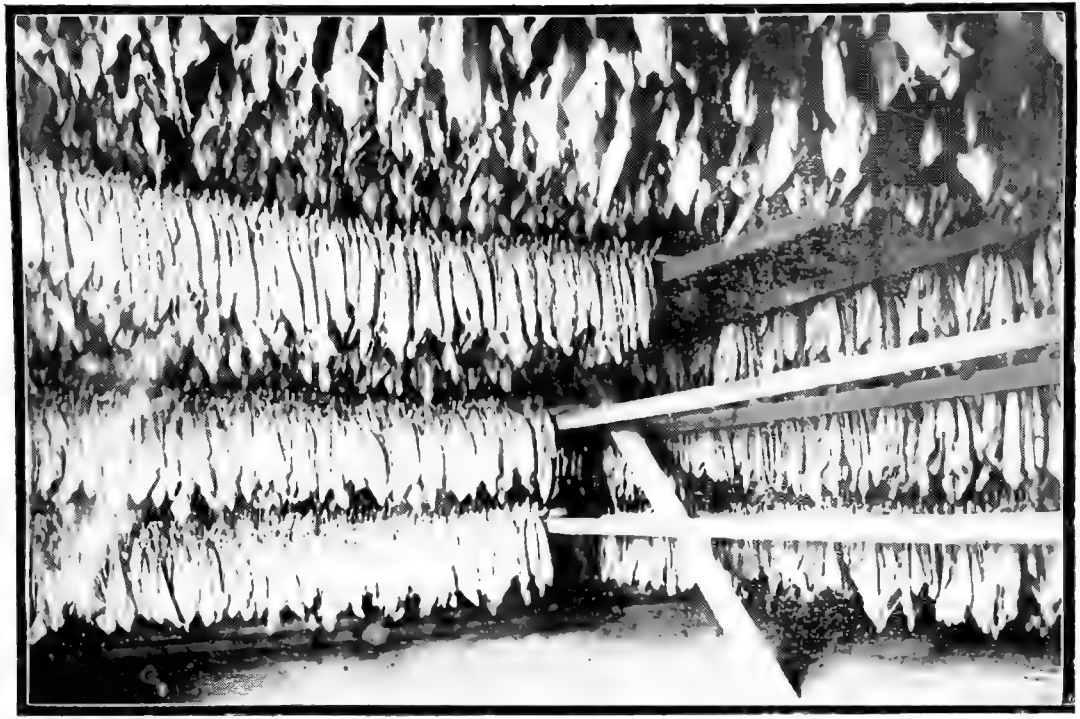
it off without impairing the terminal bud of the plant.

Suckering is the process of removing the suckers or offshoots formed in the leaf axils. If these suckers are allowed to develop they will injure the main crop by dwarfing the plants and the individual leaves.

HARVESTING

All the leaves of the tobacco plant do not ripen at the same time. The lower leaves ripen first and the younger leaves towards the top last, necessitating from three to four cuttings in order to get all the leaves of the same degree of ripeness. This method of cutting the leaves one by one is employed where the tobacco is grown for wrapper but seldom for filler. The usual method for filler is to either cut the whole plant with all the leaves attached, close to the ground, or to cut the plant stalk off in sections, each section having one pair of leaves attached. The method best adapted will depend upon local conditions as well as the class of tobacco produced. A wrapper leaf must be of a uniform ripeness in order to attain the standard of perfection. It must of course be free from blemishes, such as worm holes and rents, and must therefore be handled very carefully all through the process of growing and harvesting. A filler leaf is very much improved also if cut and handled in the same manner.

If the leaves are picked off one by one they are either placed carefully in flat baskets and carried to the drying barn and there strung on strings so that they can be hung up or they are strung directly in the field and carried on poles to the barn. The stringing consists of running a needle, threaded with cotton twine, through the base of the



View in tobacco barn

midrib of a large number of leaves, said string is then hung in the barn attached to the poles or wires. By cutting the plant stalk with a pair of leaves attached the poles are used for direct support, the pair of leaves hanging astride the pole. When the whole plant is cut, strings are run through or looped around the base of the stalk and the whole plant hung up in like manner as the single leaves.

In fields under shade two main crops are sometimes grown in one season, so as soon as the first crop has been harvested the stalks are pulled up and a second crop planted. Usually however the stalks are cut off near the ground, allowing rattoons to spring up. These rattoons then produce another crop, and often two rattoon crops are harvested, depending largely on the fertility of the field. A well fertilized field yields, not alone a good first crop, but also good rattoon crops, whereas a poorly fertilized field yields a poor first crop and no rattoons.

CURING BARN

There are no strict rules governing the size of the curing barn, nor the material of which it should be made but there are certain requirements that must be complied with. In a well constructed barn it should be possible to control the air current, the light, the temperature and the humidity but this is very difficult in the ordinary barn as constructed to-day. The draft passes directly through the doors or ventilators and the leaves hanging nearest these openings always receive more air than those in the middle of the barn. The same is true of the light, although the ventilators are not open to admit the direct rays of the sun, the leaves cure unevenly if not subjected to the same

amount of light,. These things are not so serious however, as the humidity. If the air is very dry, which it may happen to be for a long period of time, it is difficult to retain the proper amount of moisture in the barn. But it is worse still, when the air is laden with moisture, in which case it is almost impossible to prevent mould in some parts of the barn.

It would of course be possible to overcome all of these difficulties if it were known just what conditons are best for the tobacco, but unfortunately the conditions must be different according to the condition of the leaves. A leaf grown in a certain soil, with certain plant food and under certain climatic conditions, requires a different treatment in the barn from a leaf grown under other conditions. This involves problems in plant physiology not yet solved.

The general plan of the barns in Cuba and Porto Rico is a width of about 30 feet and about the same height, with a length according to the size of the field. The materials used are boards for the sides and palm leaves for the roof or simply a frame work covered entirely with palm leaves. Ventilation is secured through a door in each end and usually ventilators in the sides.

CURING

The palm thatched barn has the advantage of not being much subjected to sudden changes in temperature. During the first period of curing the air current is kept up continuously but not rapid. Later, when the leaves are well colored ventilation is often rapid and intermittent. During hot days as well as damp days or nights, the ventilators are kept closed, and during continuous damp

Curing barn thatched with palm leaves

weather open charcoal fires are cometimes placed on the floor in order to dry up excessive moisture.

The time for curing varies according to the class and condition of the leaf. A thin shade grown wrapper cures in less than four weeks under favorable conditions, while a filler attached to the stalk requires much longer time.

The cured tobacco leaf should not be handled when it is dry and brittle and it is therefore often necessary to wait sometimes for damp weather before taking the tobacco down and removing it from the poles.

FERMENTING

After the tobacco is cured it is placed in large piles, ranging from a half ton to several tons, and left until the temperature rises to 120 to 130 degrees Fahrenheit, after which the pile should be torn down and remade.

No exact rule can be given regarding temperature, as it depends upon the condition of the leaf. If much moisture is present fermentation goes on rapidly. If very dry it ferments slowly. During fermentation the leaf changes in color, aroma and burning quality. If the fermentation is rapid and the temperature high the color of the tobacco becomes dark while slow fermentation and low temperature produces a brighter leaf. In fermenting a thermometer should be used to ascertain the temperature if all other conditions are known but the practical man with years of experience, by placing his hand in the center of the pile judges the temperature at which it must be remade. This of course does not produce the best results, but on account of it being impossible at the present time

to give specific instructions, the thermometer in the hands of an inexperienced man is certainly less desirable.

SORTING AND BALING

After fermenting, the leaves are sorted and graded according to size, texture, color and perfectness, often making over thirty grades.

A first class shade grown wrapper will run about 160 leaves to the pound, if it falls a great deal below this it will be too heavy for that class, no matter how large and perfect the leaves may be. Wrappers are baled according to number of leaves and not according to weight. A bale of first class wrapper contains 9,600 leaves, second class 11,200, third class 12,800, fourth class 14,400 and fifth class 16,000 leaves.

When baling, the tobacco is made into bundles called "manos" (hands). Four of these manos are again tied into bundles called "carrotes" These bundles are tied together with a strip of the inner bark of the emajagua. The "carrotes" are then wrapped in the leaf sheath of the royal palm called "jagua". 80 "carrotes" making a bale which is the standard size. Of course the filler and low grade wrapper is not baled according to number of leaves, but a hand is an ordinary hand-full, four hands make a "carrote" and 80 "carrotes" make a bale.

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