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THE PRODUCTION OF WHITE BURLEY TOBACCO

By E. J. Kinney

The name "White Burley" refers both to a variety of tobacco and to the cured leaf of that variety. White Burley is the favorite type of leaf for the manufacture of chewing and smoking tobaccos for domestic use, and is also used extensively for cigarettes. Practically the entire production—an average of about 280,000,000 pounds yearly—is consumed in this country. Nearly 80 percent of the crop is grown in Kentucky.

VARIETIES OR STRAINS OF WHITE BURLEY.

White Burley tobacco originated about 65 years ago as a sport or mutation from one of the dark, or Virginia, varieties still used to produce the dark leaf of western Kentucky and Virginia and the flue-cured tobaccos of Virginia and the Carolinas. White Burley differs from all other kinds of tobacco in the appearance of the growing plants. It has cream-colored stalks and leaf veins and very light green leaves. **White Burley**—not Burley—is the varietal name, indicating the light color of the plants. Apparently, the original variety was not a fixed type, and numerous strains have been developt, differing in character of the plants, length of time required to mature, and shape and texture of the leaves. For many years after its discovery, White Burley was used principally for the manufacture of plug tobacco. For this purpose a heavy grade of leaf is preferred; consequently strains that produced a large proportion of such leaf were developt and were generally grown. The so-called Red White Burley, Rainbow White Burley, Yellow and Red Twist-bud White Burley, and Big Silk White Burley were among the popular varieties in former years.

Beginning about 30 years ago, a constantly increasing percentage of the White Burley crop has been utilized for the manufacture of smoking tobacco and more recently for cigarettes. At the present time the amount used for these products greatly exceeds that used for making chewing tobacco. In the manufacture of smoking tobacco and cigarettes, a large proportion of light, colory leaf must be used in order to give the products good burning qualities, an attractive color and mild flavor. Manufacturers found difficulty in most seasons in securing the needed amounts of such grades of leaf, and they soon began to command much higher prices than the heavier red grades. In order to produce as much colory leaf as possible, growers have largely discontinued the use of the old Burley varieties and are growing instead varieties that produce leaf with light body, which gives better color when cured. While these varieties give smaller yields than the heavy strains, most growers believe that the better quality more than compensates for the lower yield. As yet no variety has been produced that will give both color and heavy yield. In tests at the Kentucky Experiment Station the lighter varieties have yielded about 200 pounds per acre less than the heavy, when the yield of the latter varies from 1200 to 1500 pounds per acre. On land in especially good condition the medium heavy sorts give good quality, as a rule, and can be safely used.

Most of the leading strains of light tobacco happen to be of the standing-up type, that is, the leaves grow more or less upright instead of drooping. However, the lightest variety of tobacco ever grown in the White Burley district—the original Halley—was a drooping type, whereas several standing-up varieties have been developt that produce heavy red leaf. The most extensively grown of the standing-up varieties are the Kelley, Judy's Pride, Halley's Special, Vimont, Pepper, and the Kentucky Experiment Station Root-rot Resistant strains. The Greenbrier is an excellent drooping type, and some of the Twist-bud strains give quite colory leaf. Seed of the older, heavier sorts is difficult to obtain. The purchaser of seed should designate the strain he desires, not ask for simply "White Burley" or "Improved White Burley," as all strains are White Burley.

SOILS FOR WHITE BURLEY TOBACCO.

Good drainage of both surface and subsoil is especially necessary for the production of good White Burley tobacco. The excellence of the Bluegrass soils of Kentucky for Burley production probably may be attributed to the porous nature of the subsoil, which permits surplus water to drain away quickly. Good drainage also means good aeration, which seems to be an important factor in producing smooth, colory leaf. The soil must be well supplied with plant food. White Burley is distinctly a rich-land tobacco, and attempts to raise it on poor soils or even those of moderate fertility are certain to give disappointing results, unless manure or fertilizers, or both, are used liberally.

Neither manure nor fertilizers give good crops, however, on compact soils low in organic mater, as physical condition of the soil is perhaps even more important than plant food content. Heavy sods, especially bluegrass sods, give good physical condition and, if of long standing, are likely to be rich in accumulated available plant food. Orchard-grass sods and redtop sods are satisfactory also. In the coarser, more open soils, such as occur in the hilly parts of the Bluegrass Region, good quality of leaf may be produced after clover. Good leaf may often be obtained following corn or the small grains provided the soil is well supplied with organic matter. With a crop as expensive to grow as tobacco, it is highly profitable to provide the best possible soil conditions for its growth. On heavy soils, or soils not in good physical condition, it is more profitable to attempt to produce as large a yield as possible, rather than fancy leaf.

FERTILIZERS FOR WHITE BURLEY TOBACCO.

The fertilizer experiments on the Kentucky Experiment Station farm at Lexington show that nitrogen is the most important element for tobacco in the Central Bluegrass Region, since it produces a larger increase in yield than the other elements. Outside the Bluegrass Region, phosphorus gives the largest increase. A fertilizer analyzing 4 to 5 percent of nitrogen, 8 to 10 percent of phosphoric acid, and 4 to 5 percent of potash is probably as satisfactory as any that

can be used. For those who prefer to mix their own fertilizer, 4 parts of nitrate of soda or 3 parts of sulfate of ammonia, 5 parts of superphosphate, and 1 part of sulfate of potash give a satisfactory mixture. The amount to use depends upon the productivity of the soil. For soils that will make 40 to 50 bushels of corn per acre in good season, 500 to 600 pounds per acre is recommended; for soils making 50 to 60 bushels, 400 to 500 pounds of fertilizer. Fresh soils in a very productive condition do not require fertilizers usually; especially is this true in the Central Bluegrass Region. A side dressing of 100 to 200 pounds of nitrate of soda per acre or equivalent amounts of other soluble nitrogen fertilizer often may be used profitably to stimulate a slow-growing crop.

Recent developments in the fertilizer industry have made it possible to manufacture much more highly concentrated fertilizers than formerly. These highly concentrated fertilizers are now on the market and undoubtedly will soon be offered for sale in all parts of the country. Very little information is available regarding their effectiveness, but it is assumed that they are relatively as effective as any other fertilizers. It is necessary to apply these fertilizers very carefully in order to avoid injury to the young plants.

In using highly concentrated fertilizers for tobacco, one should be selected that has the percentages of plant food in about the same ratio as in the fertilizers previously recommended; that is, a 1-2-1 ratio, the first figure referring to nitrogen, the second to phosphoric acid, and the third to potash. A 12-24-12 or a 15-30-15 analysis has this ratio. Of course much smaller amounts of these concentrated fertilizers will be required than of those of the ordinary type. For example, when the recommendation is for 500 pounds of 4-8-4 analysis, only about 165 pounds of the 12-24-12 analysis should be used, or 135 pounds of the 15-30-15 analysis.

EFFECT OF FERTILIZER ON QUALITY.

In the limestone region of Central Kentucky, fertilizers seem to have very little effect upon quality in the average season, except where the soil is not sufficiently productive to give a fair growth of plants. Probably an excessive amount

of nitrogen fertilizer or heavy applications of manure will affect quality adversely on soils where drainage is slow and aeration imperfect. On "quick" soils, even very large amounts of nitrogen fertilizers seem not to be injurious. In sections where soils are deficient in phosphorus, the use of phosphate in the fertilizer will usually improve quality materially. The same thing is doubtless true of potash. Where the weather following transplanting is cool and wet, commercial fertilizers may have a decidedly beneficial effect upon both yield and quality. In 1929, when such seasonal conditions occurred, fertilized tobacco maintained a steady growth thruout the wet period and was sufficiently mature to harvest before the drouth which followed became severe enough to cause injury. This early-maturing tobacco gave good yields of excellent quality leaf. On the other hand, much unfertilized tobacco made a very slow growth during the early part of the season and the drouth prevented its development later. Such tobacco gave low yields of poor quality leaf.

Lime is not often of direct benefit to tobacco; in fact, tobacco planted on land that has recently been heavily limed may be injured. Indirectly, lime may be of benefit by making better grass and clover in the tobacco rotation. Its beneficial effects may be obtained without much danger of any unfavorable results by using moderate applications on the crop following tobacco in the rotation.

APPLYING COMMERCIAL FERTILIZERS.

Unless very large amounts of fertilizer are used, row application is preferable to broadcasting. Four hundred to six hundred pounds per acre, perhaps much more, can be used safely in the rows if properly applied. To avoid injury, the fertilizer should be mixed thoroly with the soil or so applied that it will not be directly in contact with plant roots. A fairly safe job can be done with the ordinary one-horse fertilizer drill owned on most farms. A narrow shovel should be used on the drill so as to leave a small furrow. A piece of heavy log chain should be fastened to the rear of the drill frame in such a way as to form a half loop as it drags on the ground behind the drill. This will cover the fertilizer and

level the ground. After sowing the fertilizer, the field should be marked out again with the sled marker. When setting the plants by hand, they should be set on the edge of the mark, and in using the machine transplanter the shoe should run on the edge of the mark rather than in the center. If a fertilizer drill is not available, the fertilizer may be distributed by hand in the furrows made by the marker and covered by running a hand garden plow or a single shovel plow with a narrow shovel along the edge of the furrow. A corn planter with fertilizer distributor may also be used. In order to sow the desired amount of fertilizer, however, it is necessary to run twice in each row. The corn planter serves as a marker as well as a fertilizer distributor.

The rate at which any distributor delivers fertilizer varies greatly, depending upon the amount of moisture in the fertilizer, its mechanical condition, and what materials are used in its manufacture. It is necessary, therefore, to test the drill to determine how much fertilizer is being sown. This can be done by weighing out a definite amount of fertilizer —say 20 pounds—and noting how many feet of row it sows. At the rate of 100 pounds per acre, 20 pounds should sow 2500 feet of row; at a 200 pound rate, 1250 feet; at a 300 pound rate, 835 feet; and at a 500 pound rate, 500 feet.

MANURE FOR BURLEY TOBACCO.

At the Kentucky Experiment Station stable manure has been as effective as fertilizer. Ten tons per acre of average farm manure should be sufficient on soils in fair condition, and for thin soils the amount may well be increased to 15 tons per acre. Outside of the Central Bluegrass counties manure should be supplemented by about 200 pounds per acre of superphosphate drilled in the rows. Manure may be slightly more effective if used as a top-dressing after the ground is plowed; however, if coarse and strawy, it cannot be used in this way. Chicken manure, especially if quite dry and free from straw or other bedding material, contains much more plant food than ordinary stable manure and less need be used. A top-dressing of 4 to 5 tons per acre should give good results.

RAISING THE PLANTS.

The growing of plants is fully discussed in Kentucky Extension Circular 77, entitled "Tobacco Plant Bed Management." It will be sent free on request. Only a few of the most important features of plant growing will be considered here.

The best land on the farm should be selected for the plant bed. New ground or old sod land is best. It is best to use a new site each year in order to avoid root-rot and other diseases.

The use of fertilizers is a wise precaution, even when it is thought the soil is very fertile. Fertilizers are preferable to manure, as a rule. Tobacco stalks should not be used, as they may introduce disease. The fertilizer used should contain at least 3 percent of nitrogen. Little or no potash is required where beds are burned, but it should be included where beds are steamed. Two pounds of fertilizer per hundred square feet of bed is a liberal application; it is not advisable to use more. The fertilizer should be applied after the bed is burned or steamed, and raked into the soil.

Where plants make an unsatisfactory growth, the application of 5 gallons of a solution of 10 pounds of nitrate of soda in 50 gallons of water to each 200 square feet of bed will be of great benefit. The solution should be sprinkled over the bed with a sprinkling can and should be followed with an equal amount of clear water to prevent injury to the plants.

Plants should never be allowed to suffer for water. Watering a bed is a big task, but it pays well in dry periods. A thoro wetting once a week is far better than frequent light sprinklings. A barrel of water to each 100 square feet of bed is not too much.

One half a teaspoonful of good heavy seed to 100 square feet of bed is ample. An ounce of seed is sufficient to plant a bed 250 feet long and 9 feet wide. If each ounce of seed is mixed thoroly with a peck or more of slightly moist—not wet—sand or ground limestone, even distribution, even in windy weather, is possible. At least 200 square feet of bed should be allowed for each acre of tobacco to be grown.

PREPARATION FOR PLANTING.

Fall plowing of heavy sods is desirable. In case this is not practicable, the breaking should be done in early spring. For other lands, early spring plowing is best. Cover crops of rye or other grains should be plowed under when about 12 to 15 inches tall. It is a mistake to permit the growth to become large. Disking at intervals is necessary to keep down grass and weeds. Dragging puts the land in good condition for transplanting.

TRANSPLANTING.

Close setting—14 to 16 inches—tends to give colory, smooth leaf. Rows should be 3½ feet apart. Machine transplanting is preferable to hand setting. The latter part of May and first of June is the best planting period. July 1 may be regarded as very late setting, with only fair chances of producing a good crop.

CULTIVATION.

The chief benefit of cultivation is the killing of weeds. Preventing the formation of a soil crust also saves moisture while the plants are small. It is desirable to go over the field with hoes as soon as the plants start growing, to check weeds and break up the crust around the plants. Earth should be drawn around plants having long shanks. Further hoeing is necessary only to keep down weeds. Fairly shallow, frequent cultivations should be given until the spreading leaves make it impossible to get thru the rows without damaging the plants.

TOPPING AND SUCKERING.

The color and body of White Burley leaf are influenced greatly by the practices followed in handling the crop after the flower bud appears. The practice usually followed in the past was to top the plants as soon as the "button" showed, leaving 14 to 20 leaves, depending upon the vigor of the plant, weather conditions, etc. Suckers were kept pulled closely. This method of handling, still followed by many

growers, tends to cause the development of large, thick leaves which give heavy acre yields but which may not be very colory, especially in certain seasons and on some kinds of soil. Higher topping usually results in the production of a thinner, brighter leaf of less size and weight. Allowing suckers to grow to a large size before pulling has the same tendency. In recent years, suckering practices intended primarily to reduce labor have been extensively adopted. Unquestionably these practices often reduce yields, but give higher quality of leaf. It is the opinion of many growers that the reduced cost of production and the higher prices received for the leaf more than compensate for the reduction in yield. It is probably impossible to obtain the highest quality of leaf and the highest yield at the same time. Leaves with heavy body, necessary for heavy yield, do not cure as bright as thin leaves.

In 1928 the Kentucky Experiment Station began an experiment designed to give accurate information on the relative yield, quality of leaf and net returns from tobacco managed in various ways as regards topping and suckering. The tobacco follows corn in a four-year rotation of corn, tobacco, wheat and clover. The land is manured for corn, and the tobacco is fertilized with commercial fertilizers. Four methods of handling were tested the first year. These were as follows:

1. The plants were topped when the flower buds or the "button" appeared, and suckers were removed frequently. This is the old standard method.

2. The plants were topped early and the two top suckers allowed to grow and form leaves. This tends to prevent the development of succeeding crops of suckers. The suckers left were topped at a height of about a foot and remained until the tobacco was harvested. They were then discarded. Some growers harvest them with the plant if the leaves are of fair size.

3. The plants were allowed to bloom out fully before topping and the suckers allowed to grow until the tobacco was harvested. In wet years it is planned to sucker the plants once before harvest.

4. The plants were not topped or suckered until the tobacco was ready to cut.

In 1929 one other system of management was included. This was as follows:

5. Topping was delayed until all the plants had bloomed and a few pods had developt on the seed heads. Suckers were kept closely pulled until harvest time.

Two years' results are not sufficient to permit drawing any definite conclusions, and the experiment will be continued for a number of years. The season of 1928 was fairly normal, but 1929 was decidedly abnormal. The weather following transplanting was very wet. This was followed by a severe drouth. Few suckers developt, and the dry weather hastened maturity of the crop.

In 1928 method No. 1 gave approximately 30 percent higher yield than any of the other methods of handling. The leaf was dark, however, and the market price of all the grades except red leaf was about 5 cents per pound less than that of similar grades produced by methods 2 and 3. Taking into consideration relative labor costs of handling, there was little difference in the net returns in all three methods. No. 4, where the tobacco was not topped or suckered until harvest time, gave the lowest yield and an inferior quality of bright and red leaf.

In 1929 both yield and quality of leaf were practically equal under all methods of management. Because of the limited production of suckers, the cost of handling did not vary greatly. The early topped and closely suckered plots gave slightly the best quality of leaf, and the untopped plots again gave the lowest yield and poorest quality. Differences were very small, however.

Similar experiments in the Connecticut Valley cigar tobacco producing region indicate that method No. 5—that is, delayed topping followed by close suckering—gives the best average results as regards yield and quality and the highest net returns per acre. The period between topping and harvest is short, and the amount of suckering necessary is

not large. This method is worthy of trial by White Burley growers. It seems very doubtful if method No. 4—topping when the tobacco is harvested—is profitable, as both yield and quality were the lowest of any method.

HARVESTING.

The yellowing of the lower leaves on the plants indicates that White Burley tobacco is beginning to ripen. The yellowing gradually extends to the leaves higher up on the plant until, in fully ripened Burley, even the top leaves have a decidedly yellow cast. Good, colory leaf is obtained by cutting at any time after yellowing begins; but if cut when quite immature, the yield is much less than if the tobacco is allowed to become ripe. Tobacco cut green is also more likely to damage in the barn than riper tobacco, in case of unfavorable curing weather. On the other hand, it does not pay to let tobacco stand until the lower lighter leaves become damaged, as these are among the most valuable on the plant. Furthermore, very ripe tobacco does not seem to color as well in curing as that not so ripe. The tendency recently has been to cut White Burley too green, resulting in smaller yield and, in many cases, poor quality. The best stage to harvest is when the middle leaves on the plant show a distinct yellow color. Cutting at this stage will give practically the maximum weight of cured leaf, as good color as may be obtained, and the tobacco will not damage easily in the barn.

White Burley tobacco is very easily injured by drouth. The leaves yellow and burn badly, regardless of the stage of maturity. Tobacco that has begun to burn severely should be harvested if of sufficient size to pay for cutting. Tobacco cut at this time will give good quality of leaf even tho immature.

Splitting the stalk is the most common practice in harvesting White Burley tobacco, but in recent years spearing has also been practiced extensively. In splitting, the stalks are split to within a few inches of the ground before cutting the plants, which are then straddled over the sticks. In spearing, the stick is pushed firmly into the ground and a spear head placed on the top end. The plant is then speared

thru the stem near the butt and so forced down on the stick. Tobacco sticks should be well sharpened, so they can be forced into the ground easily. Splitting the stalk is preferable to spearing where experienced labor is available. The tobacco cures more rapidly, is less likely to be attacked by houseburn in damp weather, and probably has slightly more weight. Spearing is a more rapid way of harvesting, however, and requires less skill. In ordinary seasons, it is just about as satisfactory as splitting.

White Burley tobacco sunburns quickly and, in hot, sunny weather, it is not advisable to cut it in the middle of the day unless the sticks of tobacco are piled. In placing tobacco on the sticks, the butts of the plants should be toward the sun. Tobacco should be allowed to wilt a few hours before hauling to the barn, and it should be carefully handled to prevent bruising. Bruised spots on the leaves remain green when curing is completed, which detracts from the appearance of the tobacco and lowers the grade.

CURING.

The usual practice in housing White Burley tobacco is to put five to six plants on each stick and space the sticks 8 to 10 inches apart on the tier rails. With small plants, somewhat closer spacing is permissible. It is dangerous to "crowd" barns, however, because where plants are hung close together a few days of damp weather may cause serious losses from houseburn in the early stages of curing.

The proper curing of tobacco involves much more than mere drying. Chemical changes take place which develop the color, flavor and aroma characteristic of the cured leaf. In air-cured tobacco, which includes White Burley, these chemical changes take place slowly and only while the leaf contains moisture. Consequently, the drying must not be too rapid. The most common result of too rapid drying is the greenish tint of the leaves, so objectionable to buyers. After filling the barn, doors and ventilators are usually left wide open for several days, or until the tobacco is thoroly wilted. If the weather is very hot and dry, however, full ventilation should be given only for a short time. At the

first indications of yellowing of the leaves, most of the ventilators should be kept closed, as long as the weather remains fair. This keeps the air in the barn warm and moist, conditions which favor good coloring of the leaf. As the leaves begin to turn brown, faster drying is desirable, and the barn should be well ventilated until the leaf is thoroly dry. On windy days, ventilators should be closed to prevent shattering of the leaves.

Much cloudy, rainy or damp weather makes it very difficult to get good results in air curing. In fact, it is sometimes almost impossible to prevent injury by houseburn except by using artificial heat. Houseburn is caused by an organism which seems to be always present on the leaves but which causes no damage until the leaves begin to yellow or die, and then only when the weather remains very damp and warm for two or three days. Under these conditions, the organisms develop and cause a rotting of the leaves. There are few years that houseburn does not cause considerable loss in all the air-cured tobacco districts, and in some years the losses are very heavy.

When the outside air is warm and saturated with moisture, as during times of almost constant rain and continued cloudiness, no amount of ventilation will be of any benefit. If the tobacco is at the "houseburn" stage at such a time, houseburn is certain to develop unless the tobacco is dried out with artificial heat. Coke stoves, usually called salamanders, are much used in the White Burley district. They are round, open top, sheet-iron stoves, usually made by local tinsmiths, and are relatively inexpensive. Enough of these stoves should be used to raise the temperature in the barn 8° or 10° F., or sufficiently to dry the leaf. Eight or ten in a 5-acre tobacco barn are necessary to accomplish this, unless the barn is unusually tight. Oil coke may be burned without stoves; that is, fires may be maintained on the ground. This kind of coke is difficult to obtain in most places. It is best to maintain the fires until the weather becomes favorable. Coke fires do not injure White Burley tobacco, and a temperature up to 100° F. will not affect the character of the leaf. Experiments at the Kentucky Experiment Station have shown that White Burley can be completely cured with arti-

ficial heat where the temperature does not exceed 100° F. and still be identical in quality with air-cured leaf.

Where the outside air has any drying capacity whatever —that is, it is not saturated with moisture or is much cooler than the inside air—thoro ventilation may prevent houseburn. Blowing air thru the barn with the blower on a grain separator or ensilage cutter is beneficial when the outside air can still take up more moisture.

After curing is completed, there is no further danger from houseburn. If the tobacco stays damp for long periods, however, the leaf is likely to be darkened. This can be prevented by using the coke stoves to dry out the tobacco.

Very cool weather following harvesting may cause tobacco to cure green. Late harvested crops may need artificial heat to produce good curing conditions.

If barns are stripped and otherwise tight, some ventilation should be provided near the top of the barn when using heat in curing, in order to permit moisture to escape. In most barns, cracks provide more than enough ventilation.

STRIPPING AND GRADING WHITE BURLEY.

After the tobacco has dried out completely, stripping may begin as soon as the leaf can be got in "order"; that is, has taken up enough moisture to be handled without breaking. Light rains followed by warm, cloudy or foggy weather give the best conditions for getting leaf in order. When the temperature is low, the leaves will not take up moisture. Ventilators should be opened to allow the moist air to circulate freely thru the barn, but closed as soon as the leaf handles well. It is not desirable for the tobacco to take up an excess of moisture, as this tends to darken the leaf while in bulk, especially if the weather remains warm. The tobacco is kept moist by "bulking"; that is, the sticks of tobacco are ricked with the tops of the plants overlapping in the middle and the butts on the outside. The tobacco should be bulked as firmly as possible and weighted with tier rails. The piles should then be covered carefully with tarpaulins, blankets, etc. Sometimes tobacco in the bulk dries out in

spite of all precautions. A little warm water sprayed on the butts will often bring it back into good handling condition. Early in the fall, while the weather is still warm, it is unsafe to leave tobacco in bulk very long. Only as much should be taken down as can be stripped in a few days.

A well-lighted stripping room is necessary in order to grade leaf properly. The windows should face the north or, better yet, top lights over the stripping bench may be provided. In the latter case, a stripping shed must be built outside. This is preferable to having the room in the barn, whichever method of lighting is used. The stripping bench should be about 2½ feet wide and 3½ feet high. Five to six men can strip to better advantage than fewer, each man taking care of not more than two grades. Consequently, the bench should be long enough to provide space for six men, or about 18 to 20 feet.

When a full crew is working—that is, six strippers—the first man removes the thin, chaffy leaves at the bottom, known as flyings, or sand leaves, and passes the plant to the next man, who takes off the next two to four leaves, known as **trash** leaves. The trash leaves are longer and sounder than the **flyings** but very light in body. The next man removes the **lugs,** also light in body but full size and sound. The next grade is known as **bright leaf.** The bright leaf, usually called "leaf", has a good body but is not so colory as the lugs. The top leaves, known as **red leaf,** have heavy body and are dark red in color. In some cases there will be two or more short red leaves at the top of the plant, known as **tips.** These are now usually thrown in with the damaged leaves of the various grades, such as houseburned leaves, partly green leaves, etc., or, if of fair quality, are put with the red leaf. The sixth man usually carries in the tobacco, carries out the stalks, and collects and ties up the damaged leaves. Of course, where fewer men are working, each man must handle two or more grades.

In careful grading, the leaves in each grade are further sorted into two or even three groups, according to length and soundness. About twenty leaves are tied together in a hand by wrapping a piece of leaf around the butts. The

hands are hung on sticks and bulked down in order to prevent drying. In early fall stripping, it is sometimes advisable to hang up the tobacco again after stripping, as it may be damaged in the bulk in warm weather. Careful grading and neat tying add enormously to the appearance of tobacco, and appearance is an important factor in determining the price that leaf brings.

MARKETING.

The loose leaf system of marketing, by which practically all White Burley tobacco is now sold, has as one of its most attractive features that of convenience. It is possible for the grower to sell any portion of his crop whenever ready for market, which is often desirable, not only because of financial considerations, but also because it gives space in the barn needed for taking down more tobacco and piling up stalks. Holding all the leaf until stripping is finished makes heavy losses in case of fire or windstorm. On an average, the grower is likely to get as much for his leaf at one time as another.

Selling to the speculator is not likely to be a profitable practice. The speculator cannot long stay in business unless he makes a profit. Consequently, on the average, the prices he pays to growers are certain to be lower than floor prices.

It may be remarked that tobacco in good order not only has a much more attractive appearance than leaf that is quite dry, but is considerably heavier. It pays to sell when moisture conditions are favorable for keeping the leaf in good condition. Very high order is not desirable, however, and buyers discriminate against "wet" tobacco.

INSECT CONTROL.

The tobacco horn-worm, usually designated simply as the "tobacco worm," is the insect that must nearly always be combated. It can be controlled easily by dusting the plants with Paris green or arsenate of lead. Paris green is very effective, but must be applied very evenly and sparingly to prevent burning the leaves. It is also irritating to the skin, and often the man dusting the tobacco suffers much

discomfort. Arsenate of lead will not burn the tobacco plants or cause discomfort to the man applying it. It sticks to the leaves better than Paris green and, consequently, is effective longer. It can be seen on the plants, which helps in getting it evenly distributed. It is not as effective in killing large worms as Paris green unless applied heavily. A good fan duster is necessary to apply it, but such a duster is decidedly preferable to the small bellows, even for Paris green.

Cutworms of various kinds are often troublesome both in the plant bed and in the field while the plants are small. In the plant bed, thoro dusting with arsenate of lead usually is effective. In the field, no very effective method of control has been found. The plants that are cut off are usually replaced. The worm can usually be found near the cut off plant and destroyed. Freshly cut clover or other succulent material, sprinkled with Paris green and dropped along the rows of plants in the evening, is sometimes quite effective in destroying cutworms.

Wireworms, the larvae of the click beetle, often cause serious losses in sod ground. They are slender, reddish worms which eat the roots and underground stems of the young plants. If the early transplanted crop is badly injured or almost destroyed by wireworms, it is a good plan to wait a week or more before resetting. No certain remedy has been found for the wireworms.

Flea beetles often puncture the leaves of tobacco plants in the bed and sometimes entirely destroy the plants shortly after they appear. Occasionally they damage the plants in the field to some extent. They seldom cause much damage in beds well protected by good tobacco cotton. Dusting the plants with air-slaked lime or spraying with Bordeaux mixture is effective in preventing damage both in beds and in the field.

Grasshoppers are often very troublesome on tobacco in late summer, especially in dry seasons when other forage is lacking. Tobacco close to grass fields may be practically ruined. Tobacco is usually so large at this time that spreading poison over all the tobacco is not practical. If the plants on the outside of the field are dusted thoroly when depreda-

tions first begin, it may prevent further damage. The so-called "poison bait" is effective in some cases in destroying grasshoppers. It is made by mixing bran, 40 pounds; molasses 2 quarts; Paris green, 1 pound. Enough water is added to make a thick mash. It should be put around the edge of the field in the evening or very early morning. The poison bran mash is also used successfully for cutworms.

DISEASES.

Black root-rot, a soil-borne fungous disease attacking tobacco, is widely prevalent in Kentucky and unquestionably reduces the yield many millions of pounds annually. The most severe losses are likely to occur when the growing season is cool and wet. This disease, as the name indicates, causes more or less rotting of the roots of tobacco plants, which, of course, affects their growth. On badly infected soils, tobacco may stand for weeks without making an appreciable growth or plants may die. Growers unfamiliar with black root-rot often attribute the injury to insects, particularly wireworms. Wireworms kill or weaken the plant by boring thru and destroying the underground part of the stem. In black root-rot, the roots are affected. Examination of an infected plant will show that it is practically devoid of live roots and incapable of taking up the water and plant food necessary for growth. The dead roots are black; hence the name, black root-rot. On soils not so heavily infected the injury is not so easily recognized. When the plants grow slowly in favorable weather and wilt during the day, even when soil moisture is abundant, black root-rot is likely to be the cause. Even when infection is not severe, yields are certain to be reduced.

There is another disease that affects the growth of tobacco in much the same way as black root-rot and which may be mistaken for the latter. This is brown root-rot, also a disease of the roots. It does not cause a black appearance of the roots, however, as does black root-rot. Brown root-rot is not so frequently injurious as black root-rot and is not likely to cause so much damage. So far as is known, all the commonly grown varieties of tobacco, including the black

root-rot resistant strains, are about equally susceptible to this disease.

The Kentucky Experiment Station has developt strains of White Burley resistant to black root-rot in average seasons and giving quality of leaf equal to any of the non-resistant sorts. The use of these strains will prevent the soil from becoming infected with black root-rot. They will also permit the growing of good crops on soils already infected. Where nonresistant strains are used, severe soil infection may be prevented by using rotations in which several years intervene between the plantings of tobacco on the same fields and by the use of a new plant-bed site each season. Two crops of tobacco followed by six to eight years of grass or other crops should keep the disease from causing serious injury.

Mosaic, also known as dry weather french, walloon, and black french, and related virus diseases cause heavy losses to tobacco growers every year. Apparently, original infection in many fields in Kentucky is due to the use of natural leaf tobacco by the workers while weeding tobacco beds, pulling plants, and transplanting. Much of this natural leaf carries mosaic, which is transmitted to the plants from the hands of the users. Dr. Valleau, plant pathologist at the Kentucky Experiment Station, has demonstrated that by having the workers abstain from the use of tobacco or by using sterilized tobacco while working around the plant-bed and setting the crop, mosaic can be held down closely. Tests indicate that manufactured tobacco does not spread mosaic as does natural leaf. Where workers feel that they cannot get along without using tobacco, it is suggested that only manufactured products be used when the operations named are in progress. In changing from the natural leaf to manufactured tobacco, pockets should be carefully cleaned out or fresh clothing worn. The hands should then be thoroly washed with soap and water.

Mosaic is responsible for one of the so-called "rusts" that aften affect tobacco as it approaches maturity, causing severe damage. All mosaic-affected plants give an inferior grade of leaf. It is highly profitable, therefore, to take every

possible precaution to prevent this disease from becoming established in tobacco fields.

The various leaf-spot diseases, wildfire, angular leaf-spot, and black-fire, or rust, have caused serious losses at times, particularly in 1920. As yet, definite means of control have not been devised. It has been observed that less injury has resulted where tobacco is not topped before harvest or where very little suckering is done. Apparently, also, certain leaf-spot damage is due to imperfect nutrition of the plants and not to disease organisms. Leaf-spot due to this cause may probably be prevented by providing abundant plant food in the soil.

CONSUMPTION OF WHITE BURLEY TOBACCO.*

The impression is quite general among growers that the consumption of White Burley leaf has increased very rapidly in recent years and that, consequently, there is little danger of overproduction. Manufacturers of tobacco products and dealers in leaf are required to report to the Government every few months the amounts of tobacco leaf of different types on hand. This information, together with the production figures gathered by the United States Department of Agriculture, makes it possible to determine definitely how much of each kind of leaf is consumed or "disappears" each year.

During the 10-year period of 1920 to 1929, consumption of White Burley increased an average of about 6,000,000 pounds per year, or at a rate of 2 percent. This is a very moderate increase. During the last half of this period the average consumption was 284,000,000 pounds annually. In 1928 the consumption was 284,000,000 pounds and in 1929, 286,000,000 pounds.

Production during the first part of the period 1919 to 1928 was greatly in excess of consumption. During the last part, consumption exceeded production, but the huge carry-over prevented any shortage, and manufacturers had adequate

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*Contribution from the Division of Markets and Rural Finance.

stocks on hand at the end of the period. The relatively small average production during the years 1924 to 1928 was due to the abnormally small crop of 1927 and the relatively small one of 1928 and not to a reduced acreage; in fact, the acreage increased somewhat. The average yield of White Burley leaf has been approximately 825 pounds per acre for the past 10 years. It may be assumed that future yields will be as large or perhaps larger because of the increased use of commercial fertilizers. With this yield, 345,000 acres will supply sufficient leaf to meet present requirements, and a 2-percent increase each year will take care of increased consumption. This would permit an increase of about 7,000 acres on the basis of a 345,000 acre crop and slightly more each year, provided, of course, consumption continues to increase at the rate of 2 percent.

According to estimates of the United States Department of Agriculture, 417,000 acres of Burley were grown in 1929. This acreage, with average yields, would produce 340,000,000 pounds of leaf, which is far above present demands. It is obvious that such an acreage is not justified by present demands and most likely will not be justified for a number of years. If production continues to expand, growers may expect prices to reach a lower level.