Trends in Tobacco Leaf Usability*

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SUMMARY

The farmers and the buyers are partners in the production and purchase of usable tobacco leaf for manufacture into products acceptable to the consumer. The blend in these products and their ultimate sales price in the market place alters over time. Both parties must continually be aware of, and react to, these changes, if they are to stay in business. The principles of leaf purchase with regard to selection of ideal subjective looks, particularly emphasizing colour, maturity and plant position, will not be radically changed, but they must be coupled with acceptable, objective chemical contents to ensure subsequent, accurate product blending and favourable smoking properties. High technology in cigarette manufacture also demands that the threshed product, after green leaf processing, notably particle size, objectionable stem, and stem in lamina, together with packing moisture and minimal foreign matter, must meet strict specifications. The growing, curing, marketing, and purchase of leaf, together with its green leaf processing and cigarette manufacture, have all become more objective in definition. Usability, in relation to all these factors, is therefore what is attractive to the buyer/manufacturer and ultimately to the consumer, but the actual inclusion of leaf in a particular product is also related to its price. Usability and price play a major role in leaf selection and these are discussed.

ZUSAMMENFASSUNG

Bei Produktion und Einkauf von geeigneten Tabakblättern für die Verarbeitung zu befriedigenden Produkten sind Pflanzler und Einkäufer gleichermaßen beteiligt. Die Mischungsgrundsätze und die endgültigen Verkaufspreise sind Schwankungen unterworfen. Beide Seiten müssen sich dieser Schwankungen immer bewusst sein und ihnen Rechnung tragen.

Die wichtigsten Kriterien beim Tabakkauf, wie das subjektiv empfundene Aussehen der Blätter, insbesondere Farbe, Reife und Blattposition, werden sich nicht grundsätzlich ändern, die chemischen Inhaltsstoffe müssen jedoch mitberücksichtigt werden, um eine gezielte Mischungskomposition und günstige Raucheigenschaften zu gewährleisten.

Bei der technologischen Zigarettenproduktion muß der Tabak nach der Trocknung auch bezüglich Schadensbild, Partikelgröße der Inhaltsstoffe, Feuchtigkeitsgehalt und Fremdkörperentfernung strengen Qualitätskriterien genügen. Tabakanbau, -trocknung, und -handel sowie Tabakverarbeitung und Zigarettenproduktion wurden zunehmend objektivierbarer. Die Verwendungsfähigkeit eines Tabakblattes richtet sich danach, was für den Käufer/Produzenten und letztendlich für den Verbraucher attraktiv ist, Mischungsgrundsätze sind jedoch immer auch von wirtschaftlichen Erwägungen abhängig. Verwendungsfähigkeit und ökonomische Aspekte sind bei der Auswahl der Rohstoffe vorrangig und werden diskutiert.

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RESUME

Les planteurs et les acheteurs sont des partenaires dans la production de tabac approprié à la fabrication d'un produit acceptable. La composition du mélange et les prix de vente sont soumis à des variations temporelles. Les deux parties doivent toujours être conscient de ces variations et doivent les prendre en compte. Les critères pour juger de la qualité des feuilles, comme l'aspect visuel et particulièrement la couleur, la maturité et la position ne changeront pas radicalement, mais ils doivent être combinés aux critères chimiques pour permettre un mélange précis avec un arôme agréable. Dans la fabrication technologique de cigarettes le tabac battu doit également être conforme aux normes spécifiques quant à la présence de côtes défectueuses et de côtes dans les strips, à la taille de particule des composants chimiques, à la teneur en humidité et aux substances étrangères. La cultivation, le séchage et le commerce ainsi que le traitement du tabac et la fabrication de cigarettes sont devenus des processus plus objectifs. L'aptitude à l'emploi d'une feuille dépend de l'intérêt du planteur/acheteur et finalement du consommateur mais aussi du prix de vente. L'aptitude à l'emploi et le prix de vente jouent un rôle important dans le choix des feuilles et ils seront discutés.

INTRODUCTION

All commercial crops, produced anywhere in the world, are cultivated for the purpose of satisfying the requirements and desires of the consumer. Many of them are consumed as is, but most may need to be prepared, processed, or manufactured, into some form, more convenient for consumption or for improved storage. In either case, the farmer and the buyer (shopkeeper, processor, manufacturer) are dependent on each other for the provision of an acceptable raw product at a reasonable price. Both the farmer and the buyer should market their products in a satisfactory condition to meet individual demands. Both require an adequate profit to finance their operations.

Unlike the majority of crops, tobacco, like tea, is harvested and sold in leaf form. Both demand factory processing following sale. The tobacco leaf is machine threshed (in a few parts of the world this is still done by hand) into lamina and stem (mid-rib), dried, stored, and aged, prior to manufacture into tobacco products 12-36 months after purchase.

This paper reviews the principles of tobacco leaf purchase, with particular reference to its usability by the buyer. The subjective and objective characteristics, desirable for its inclusion in tobacco products, notably in cigarettes, are discussed in detail. Both farmer and buyer must be aware of changes in blend modification to meet world market

demands and prices and continue to meet the challenges of such changes.

FACTORS AFFECTING LEAF AVAILABILITY AND USABILITY

It is desirable to briefly review the factors, which have had a major impact on the production and marketing techniques of the farmer over time. These factors not only influence and modify the type of leaf, which he produces, but also the characteristics desired by the buyer, both for the domestic and the overseas manufacturer. These include:

1. The breeding of flue-cured cultivars resistant to the diseases Granville wilt (*Pseudomonas solanacearum*) and to black shank (*Phytophthora parasitica* var. *nicotianae*) has allowed production on infected fields, notably in the U.S.A. Blue Mould (*Peronospora tabacina*) resistance in all tobacco types in Europe is very important. Tobacco Mosaic and other viruses, together with nematodes, notably *Meloidogyne incognita* and *M. javanica* are widespread throughout the world.

The economic impact of these pests continues to be immense. Even today new species and strains of insects, diseases, viruses, and nematodes, appear in all tobacco growing regions, to which resistance to some is unavailable. Further breeding work is, therefore, essential for the crop, perhaps to be grown at all, but certainly to maintain high leaf yields. It is of note that buyers in the U.S.A. initially showed reluctance to purchase leaf from resistant cultivars because of their poor cured looks. Even today this can occur with flue-cured cultivars resistant to Tobacco Mosaic Virus. Buyers in Europe are finding that the smoking qualities of some blue mould resistant air-cured cultivars are unsatisfactory.

2. The chemical contents of the cured leaf have become a key prerequisite to selection in its purchase everywhere. The non-acceptance by domestic and export buyers of low nicotine cultivars in the U.S.A., for example Coker139, designated by the USDA (ASCS) as discount cultivars in 1957, led to the establishment of the Flue-Cured Tobacco Quality Committee-Varieties. and the Minimum Standards Programme in 1963. Its objective was to assure that newly released cultivars possessed agronomic, physical, chemical, smoke and usability characteristics acceptable to the farmer and buyer. In 1978 a similar programme for burley cultivars was instituted, with the first review of new cultivars in 1980. Both programmes have been highly successful and U.S. cultivars are now being grown in many parts of the world.

Similar programmes have been in existence for many years in Canada, Zimbabwe, and in Europe. Particular

emphasis in Canada and Zimbabwe protocols has been acceptance by leaf merchants and tobacco manufacturers for leaf usability and physical characteristics related to manufacture, together with smoke taste, prior to certification for farmer production. All programmes set narrow standards which the industry and hence the consumer desires.

3. The publication of the first Government Smoking and Health Reports in the United Kingdom (1962) and the USA (1964) and the subsequent requirement of placing smoke chemistry content numbers on cigarette brands and their advertising has resulted in extensive research review on the type of tobacco which should be produced by the farmer for the buyer, for example, breeding selections with lower "tar" potential (13) or brands free of undesirable smoke compounds (21). Many of these selections were rejected by smoke panels.

The problem has not gone away. Indeed the directive of the European Community Council to limit "tar" limits on cigarette brands to 15 mg by the end of 1992 and 12 mg by the end of 1997 forces the manufacturers to review the leaf make-up of their cigarette brands to meet these standards and perhaps in turn to require European tobacco farmers to change the types which they grow (10). In many other countries, the industry has reduced "tar" and nicotine levels to meet consumer demands. This has been achieved by altering the characteristics of cigarette delivery systems (filter and paper) and of the leaf blend.

4. The chemical and physical properties of the leaves can vary over a considerable range. They respond continually to change in the environment, notably climate, and to the agronomic practices imposed on them and the supporting plant. It is not surprising therefore that the usability of the cured leaf by the manufacturer, the properties of its smoke, and the acceptability of the final product by the consumer, can vary markedly with time and from one situation to another. While cultural practices are reasonably standard in each location as a result of farmer experience and agronomic research, PAPENFUS (15) has clearly shown that such practices can be markedly changed in any location, such that the cured material can be modified to fit the design and manufacture of tobacco products.

Also, BEUCHAT *et al.* indicate that, in Italy, the desirability of upper stalk flue-cured leaves can be markedly improved in colour, texture and smoke properties, merely by delaying the harvest date from the previously accepted stage of maturity (3).

5. All types of tobacco demand a large number of man-hours for their field production, harvesting, curing and presentation for market. The need to reduce this amount and its cost is perhaps highlighted with the current

methods of growing oriental leaf. The availability and age of labour is further aggravating the situation. A very large percentage (85%) of all types of tobacco, flue-cured, dark and light air-cured, oriental e.g. in Europe, Asia, Africa and Central and South America, is grown on 0.5-2 hectare lots, such that the family unit is often a key to production success.

On the other hand, major changes have occurred for larger scale farmers, growing 10-200 hectares, e.g. U.S.A., Canada, Argentina, and parts of Europe, where labour is scarce and expensive. Mechanical equipment is commonplace for most operations. Bulk curing has largely replaced traditional stick barns of flue-cured tobacco and even one-tier portable frames are beginning to replace multi-tier wooden buildings for air-cured burley in the U.S.A. because of improved labour efficiency and greater economic returns (14). Such machinery has demanded considerable agronomic changes, and, in many cases, subjective quality standards have been lowered.

6. Sorting and preparing flue- or air-cured leaf for sale according to plant position, colour, maturity, and degree of blemish or damage, to produce uniform lots is essential to obtain higher prices. The removal of sand, foreign matter, suckers and mouldy leaf, of no value to manufacture, is carried out at the same time. The actual form of presentation to the buyer varies between countries. Tying of such leaf in hands e.g. Zimbabwe, Malawi, demands good sorting. Presentation in tangled loose leaf form often leads to poorer sorting and lower quality e.g. flue-cured U.S.A. and Australia. Straight laid loose leaf e.g. Canada, Italy, U.S.A. (burley), generally placed in bales for sale, also requires good sorting.

7. The development of threshing machinery occurred in the 1950s. Their installation in green leaf processing factories or stemmeries, by the early 1960s allowed the buyer (leaf dealer, manufacturer) to achieve high quantitative standards of lamina particle size and stem content, and later with the addition of silo blenders to blend the lamina to ensure accurate moisture and chemical specifications. In recent years, improved threshing and separating equipment has enabled further improvements to be made to meet the specifications required by high speed making equipment in the cigarette factories.

FARMER/BUYER COMMUNICATION

Leaf production and manufacturing requirements and techniques continually change to meet consumer demands. The buyer/manufacturer knows what leaf he wants in the market place to satisfy his requirements, both domestic and foreign. In each country, consumer tastes are slightly different. The style of leaf desired is, in

part, communicated to the farmer by the price paid. But some objective characteristics, for example, pesticide residues and chlorine content, cannot be assessed by sight during an auction system of sale. Their levels have to be assumed as satisfactory. They can be measured after the event, and the necessary adjustments made later. Where leaf is contracted, such levels are better controlled.

Tobacco agronomy scientists, whether employed by the Government, or by private industry, or by research boards financially supported by farmers e.g. Zimbabwe, have carried out an immense amount of field research, which has contributed to a considerable total and continuing knowledge of improved production methods. In turn, the Extension Services of these bodies have carried their research into the field, often by on-farm testing, and made recommendations to the farmer. The better that it is done the higher the standard produced.

The buyers (leaf dealers/manufacturers) have a vital role to play in this communication process (9). With contracting it is direct, buyer/farmer e.g. Brazil, Kenya. But with leaf purchase by Government e.g. Tanzania, China, or through farmer cooperatives e.g. Argentina, or on the auction floor e.g. U.S.A., Canada, Zimbabwe, Malawi, India, there is a direct need to inject their views and ideas on the requirements desired by their customers, domestic or export, and on the direction, which agronomy research might take. They should be represented on any relevant committees and ideally they should provide monetary contributions to such research organisations and utilise their in-house research facilities in cooperative projects e.g. U.S.A., Canada. Full success can only be accomplished through frank and total communication.

It is to be noted that the farmers in Canada and Zimbabwe own first class market facilities and buildings to market and sell their leaf. They, therefore, have a direct and close relationship with the buyers. Changes in agronomic research and leaf policy and direction can be made quickly.

LEAF CLASSIFICATION AT POINT OF SALE OR MARKET

The original concept of classification and certification of tobaccos in the market place was first developed in the 1700s in the U.S.A to improve quality and acceptance by overseas leaf dealers. The first Government classification system was developed in 1924, as a result of the Tobacco Inspection Act passed by Congress. While its original purpose was for the accumulation of statistics for Government records and reporting, it is believed that it also helped to supply the buyer with better selected higher quality leaf, and the grower with an incentive to provide this, as a means of obtaining higher prices.

This quality classification system for flue-cured (1-6) and

burley (1-5) described the looks of the cured leaf and identified each lot or pile on the warehouse floor, prior to sale, by stalk position, colour and an estimate of total quality based on ten elements or characteristics, namely maturity, leaf structure, body, oil, colour intensity, width, length, uniformity, injury and waste tolerance. These standards were not developed to express quality in the monetary sense. With some modifications, this system has the same format today.

The USDA Classification System was originally developed for smoking, chewing and pipe tobacco use. It does not take into consideration the fact that today the main use of leaf is for cigarettes. The leaf characteristics required for the former products are not entirely the same as those ingredients required by the latter.

This system has served as the basis of the tobacco leaf grade descriptive structure for most tobacco producing countries in the world (24). Indeed USDA personnel have trained, and continue to train, graders/classifiers of many countries. The actual system finally developed in any country must however be of a practical size relating to farmers' production methods, but at the same time encouraging them to produce, what is wanted in the market place by the buyer.

The Agricultural Adjustment Act of 1938 tied a controlled price support system to the Federal Tobacco Classification system. Computed prices have been allocated to each grade annually taking into consideration the Flue-cured Quality designation. The price range has not been flexible enough to truly reflect the shift in demands by the buyer and to encourage the farmer to produce those grades most desired for current cigarette usage.

It is therefore highly desirable to have a classification system, which stands on its merit, without a relationship to price support e.g. Zimbabwe. Changes in usability requirements can then signaled to the farmers, on a year to year basis, more easily by what is paid by the buyer. History has shown that farmers respond to economic signals. Communication between the farmer and the buyer is again the key.

QUALITY VERSUS USABILITY

The word *quality* in tobacco is applied to the leaf after it is flue-, air-, fire, or sun-cured.

WEYBREW et al. (25) in North Carolina, stated that, while quality in the commercial sense becomes perceptible when tobacco is taken out of the curing barn, it is not created by curing. It is the product of the cultural management and environment during the growing season. At the moment of harvest, a leaf should contain its maximum potential for quality and an optimum curing schedule merely transforms potential quality into tangible quality. Much quality can be degraded by mismanaged curing.

They defined leaf quality as the sum of its physical and chemical attributes, that best suits it for the manufacture of cigarettes. Particular characteristics assume greater or lesser importance depending upon who is making this judgement. To the grower net income is pre-eminent. Stocks has clearly demonstrated similar procedures and arguments in Zimbabwe (20).

ROGERS and MITCHEM (17) state that the art of purchasing in the 1960s and previously was based on pre-determined and continuously verified relationships that existed between physical (looks and feel) properties of tobaccos and their smoking properties. This was carried out, such that the economics involved would permit the purchaser to make tobacco products available to the consumer at prices and profit margins generally comparable to those of his competitors. The selection of these physical properties of the leaf as indicators or predictors of chemical and smoking properties was discussed in great detail. On this basis, the buyer placed his grade and price on the lot purchased.

ABDALLAH (1) considered that tobacco quality is judged in different ways by buyers, technologists, chemists and finally the smoker. The final judgment of quality is determined by the smoker, who wants an agreeable taste, aroma and strength to satisfy his smoking pleasure. He went on to state that standards of quality are not necessarily fixed. As new types of leaf, having properties different from those of the old, make their appearance, some of these may be more acceptable to the consumer and replace the original types.

However, the concepts of ROGERS and MITCHEM (17) in the past 10-15 years have become progressively blurred since methods of production have changed and standards of sorting diminished, certainly in the U.S.A. As a result, in part, AKEHURST spearheaded a need to equate the definition of quality in the agronomic sense with its utilisation value from the manufacturing or industrial viewpoint in CORESTA discussions during the late 1970s. This seems to have never been fully resolved. However, he became fully committed to the word usability compared with quality (2).

The assessment of quality is based on the subjective characteristics of the leaf and its smoking properties. Adherence to the quality image tends to be constant or static. Usability on the other hand, embracing both subjective and objective characteristics, is dynamic and ever-changing to reflect the demands of the buyer. Usability is what is attractive to a manufacturer and acceptable to consumers. Its application may come about because of a price differential. It takes subjective quality one step further in total leaf assessment. AKEHURST (2) went on to state that virtually all styles of tobacco have some degree of usability, yet some may have poor quality.

Usability has two principal elements, one related to manufacturing economy and the other to smoking char-

acter. The former takes into consideration lamina/stem yield ratio, since lamina has a much higher designated value in manufacture than stem; leaf texture, as it relates to shatter and waste or to difficulties in ordering or conditioning; incidence of blemish to improve filling value; and usability, as it relates to end use, regardless of quality. As to smoking character, usability increasingly refers to leaf chemistry, nicotine, sugars, "tar"; the choice of leaf as it relates to filters, paper and smoke dilution techniques; usability based on chlorine content and combustibility; and leaf with low pesticide residues.

LEAF COMPOSITION OF CIGARETTE BLEND

Every cigarette brand that is, or has been, on the market is made up of a particular leaf blend of tobacco types, grades and crop year. It would often include leaf, either totally or partially imported from other countries. The specific blend for each brand has been based upon a taste concept. In recent years that taste concept usually comes from a marketing or marketing research department. It is provided to blend specialists in research and development departments for development of prototypes. The final selection will probably go into test markets and hence could become a commercial product.

It is essential that the taste characteristics of all brands are annually maintained or else the consumer may consider switching brands. New crop tobaccos are blended in, and old crops phased out. This will be achieved more easily if there is uniformity in grade selection by the buyer. Such changes must be accomplished within the parameters of specific design characteristics for each brand (filters, paper, ventilation, chemistry and so on). Each brand has a basic cost. Leaf costs are perhaps easier to maintain for full priced cigarettes than for price-value or generic cigarettes.

Thus, at the beginning of each season the Chief Manufacturing Blender must:

- obtain sales forecasts for twelve months by brand and by grade blend
- calculate twelve month leaf usage by grade for all cigarettes combined
- check leaf stocks and duration of stocks
- check availability of domestic or offshore tobaccos with Leaf Buying Manager to see if there are any problems
- make leaf substitutions as necessary
- ensure that projected leaf prices are within financial forecasts

The Chief Manufacturing Blender is responsible for maintaining day to day integrity of the brands at the costs specified. The Leaf Buyer Manager buys the required leaf volume over the season at minimum cost.

THE BUYER

The speed of buying leaf from the farmer depends on the system of purchase. If this is done by a contractor, leaf merchant, government representative, or a cooperative, at a warehouse, where the farmer delivers his leaf and is present at its inspection and grading, the buyer/assessor has time to grade each pile fairly accurately and place a price on it. In Canada with the Dutch-clock system of auction, the assessor has a written list of piles offered for sale, and after inspection, places a desirability rating for his company on each list. The actual purchase is carried out by an associated clock-man who presses a button at the appropriate price on a declining pricing clock in a different place.

If the flue-cured or burley leaf is purchased, by sight, on an auction floor in the U.S.A. at the rate of 400-500 sheets (units) per hour (up to 125 kg. per sheet) of flue-cured tobacco, and about 400 pallets per hour, (up to 7 bales per pallet, 34-45 kg. per bale), of burley, the selection is very speedy. The buyer is, therefore, spending a very large amount of money (\$3.30-\$4.20 per kg.) in a short period of time. He has to think and act quickly, and decide whether the characteristics of the lot is acceptable to his company requirements. A similar situation exists in Zimbabwe, Malawi, India.

In perhaps one of the few Buyer Standardization Studies documented, Imperial Tobacco Limited (U.K.) sought in 1965, with professional help, to evaluate the characteristics of an ideal buyer (5). These were found to include high mental ability; above average analytical ability and consistency in judgment; higher than average verbal and quantitative abilities; above average sociability and personal relations skills; above average farming, buying and bargaining interests; together with, as one would expect, no colour blindness. Most of these attributes apply to any type of leaf buyer/assessor/classifier.

With greater emphasis in the 1960s being placed on selecting objective chemical and physical specifications in leaf purchase; with selection based on usability and price; together with continuous upgrading of knowledge on what the grower was doing in the field; annual in-house training and outside business management courses were considered obligatory, both by buyers and supervisors. Today with costs rising, with technical developments expanding exponentially, and with stricter specifications being demanded by the manufacturer, the need for training all leaf and green leaf processing personnel would appear paramount for buying organisations.

LEAF EVALUATION IN THE MARKET PLACE BY THE BUYER

A grading system should describe any tobacco which the farmer places on an auction floor. This means that there

are, inevitably, a large number of grades described. Some of the grade characteristics are useful to the buyer, for example, uniformity of plant or stalk position and colour. Many of the others are not necessarily synonymous with his own descriptive method of a more limited number of company grades. The buyer does not necessarily base his choice on the grade allocation on the auction floor. In most instances, his judgments are related to subsequent green leaf processing and manufacturing demands. Each customer, leaf dealer or manufacturer has his own grading system, which differ in degree. They can also vary year to year, according to the climatic conditions of the growing season and to company stocks and requirements.

In a non-auction marketing system, e.g. contract, direct Government agency, cooperative or merchant purchase, the grade descriptions must be available to the farmer, so that he can sort his tobacco accordingly in an attempt to obtain the best price. In such a system, prices per grade have often been agreed before sale.

CAMPBELL (8) has outlined the bases on which the buyer makes his assessment. Subjective looks and feel indicate stalk position and hence to some degree its level of chemistry. Colour or colour quality show maturity and chemistry. Open grain texture is generally associated with ripeness and good manufacturing properties. Ripeness is the key assessment for smoke flavor. Objectively, not seen, the leaf is purchased for its chemical contents and for its filling value, shatter resistance and strip yield. Indications of the latter are related to stalk position and blemish or damage on the leaf. Export buyers particularly have always stressed the need for ripeness and have generally purchased leaf at the top of the plant with an orange colour, indicating a good tar/nicotine ratio, fair filling value, the best strip yield, and high smoke flavour.

While many of these characteristics, have application to oriental tobaccos, the level of aroma is key to its purchase and the location of cultivation. Plant position and maturity are still important.

To follow up the buyers leaf assessment, CAMPBELL (9) has discussed in detail the crop management techniques, which the grower should follow to enhance those characteristics desired by the buyer in order to increase flue- and air-cured leaf usability and hence the price paid in the market place. A rating of their relative importance to the buyer was placed on the characteristics, for example; maturity, uniformity of stalk position, texture, chemical and smoke properties, and strip yield were rated very high; colour, body, filling value, shatter resistance were rated high. The buyer has to assume that certain acceptable agronomic practices have been carried out, for example, low chlorine content and pesticide residues. He can, however, feel and assess the moisture content of the leaf (flue-cured and burley, 16-17%). He can note if moulds or

storage pests are present, together with foreign matter, suckers, and sand, all of which are undesirable and costly to remove.

BUYER PURCHASING TECHNIQUES TO MEET NEEDS AND SPECIFICATIONS

Past

The chemical composition of leaf of all tobacco types is variable within the leaf itself, between leaves by stalk position, between varieties, between farms and soil types, and overall, as a result of climate, year to year. The farmer imposes variability as a result of his agronomic practices. The importance of variability to the manufacturer is shown in his need to reduce it such that a cigarette brand can meet its advertised smoke chemical contents accurately day by day.

The size of payment to the grower for some crops, for example peanuts in the U.S.A. is based on quantitative analysis of samples taken by the buyer to check such items as shell-out percentage, size of nut, breakage of outer shell or nut, amount of foreign matter, aflatoxin level, maturity and so on. High cost, variable tobacco leaf has to meet virtually no such objective specifications prior to purchase. Even colour has never been defined by the USDA, as it has for pecans, walnuts and french fried potatoes, which have a similar colour range to tobacco (7).

It became obvious during the 1960s that increased means of quantitative assessment of leaf in the market place was becoming much more important in all countries producing tobacco. A research project was carried out by Imperial Tobacco Limited (U.K.) during the 1960s for five years selecting flue-cured tobacco in India, Rhodesia, Canada and the U.S.A. and burley in the U.S.A. and Canada. A very wide range of samples was collected taking into consideration all subjective characteristics as discussed above, and these were described in detail. All samples were chemically analysed. The looks and the contents were statistically compared.

The results for flue-cured tobacco showed extremely useful relationships. In all years/countries, they clearly indicated that the level of nicotine was strongly related to stalk position, and colour within stalk position, and that stalk position and blemish within stalk position were important indices for sugar and filling value levels. As a result, company grade descriptions in the U.S.A. and Canada were modified to include these findings.

In conjunction with these changed grade descriptions, it was found necessary to develop a pre-purchase survey on cured tobacco by market on an annual basis to check chemistry levels. In Canada, all tobacco is harvested prior to sales opening and hence leaf samples can be taken at the

farm of grades normally purchased and chemical predictions made. In the U.S.A., sales proceed as harvesting occurs. Hence, chemistry predictions were made based on samples from the bottom of the plant. Purchases were chemically analysed too. By a combination of pre- and post-purchase analysis, it proved possible to accurately meet chemical specifications for the total season grade purchase and thus meet company required looks and contents. Buyer training, on an annual basis, was essential to success.

It must be pointed out that such a procedure assumes that the varieties grown have a fairly narrow chemical base, that the agronomic practices carried out by the farmers, particularly fertiliser use, are comparatively similar farm to farm, and that market grading is uniform and separated by stalk position and colour. It is believed that this was a classic experiment, results from which continue to be implemented, in part, by the total industry throughout the world. It emphasises how buyer techniques can be developed to purchase objective chemical specifications in leaf of all tobacco types.

Present

a) Tobacco products consumption and leaf production

It is important to put world tobacco product consumption and hence leaf production into perspective. Consumption is approximately 90-95 per cent cigarettes, 1-2 per cent pipe tobacco, 1-2 per cent smokeless tobacco, and 2-3 per cent cigar. Cigarettes are generally classified into four brand categories: Virginia or flue-cured (British style) popular in the United Kingdom and Commonwealth; dark air (French style) popular in France, Portuguese and Spanish speaking countries; oriental or aromatic style popular in Eastern Europe and the Middle East; and blended cigarettes (American blend of flue, burley, oriental and Maryland types) developed at the turn of the century and gaining market share today in Europe and Asia. Demand for dark air cigarettes is declining. Filtered cigarettes represent over 90 per cent of cigarettes sold in most countries.

In the light of these figures, emphasis must be placed on the production of leaf for cigarettes and the leaf types required for the major style of cigarettes in future demand. Furthermore, government health edicts continue to promote lower "tar" and nicotine content cigarettes, which point to a greater requirement of flue, burley, and oriental types, rather than dark air-cured leaf.

Tobacco consumption is predicted to increase by 1.9 per cent to year 2000 (3 per cent developing countries, - 0.1 percent developed). Leaf production will increase about 1.9 per cent (2.4 per cent developing, 0.8 per cent

developed) from 6.2 million metric tonnes, farm sales weight (1987) to 8.6 million in year 2000 (22, 23). Approximately 80 per cent of all tobacco types is now grown in the developing world, generally at a cheaper price than the developed countries. Flue-cured tobacco represents nearly two thirds of all types, having increased markedly over the past five years. 85 per cent is grown in the developing countries. 20-25 per cent of the world's unmanufactured leaf moves into international trade each year. (12)

It has been stated that farmers should produce leaf that the manufacturer and the consumer desire at any one period of time. If changes in the field are needed, communication between the farmer and the buyer is necessary. Such changes can be achieved by:

1) Changes in the production system

In the late 1960s, early 1970s, BAT (Souza Cruz) and Imperial Tobacco advised the farmers to change from producing lemon coloured, clear immature flue-cured leaf to orange coloured, ripe and mature, often blemished leaf, of better chemistry. This eventually strongly increased Brazil's exports. Flue-cured growers in India were encouraged to move most of their crop to the lighter soils in Andhra Pradesh and Karnataka from the original black clay soils of Andhra Pradesh. This, too, has been successful (18).

The prime example of change today is China. Manufacturers and leaf merchants are working to alter the production techniques of the current flue-cured leaf to a riper, more flavourful style, with a wider range of chemistry (higher nicotine levels and smaller sugar/nicotine and total particulate matter/nicotine ratios). Rothmans have formulated a cultural package taking into consideration local soils and climate, the cultural management of the traditional crop, its yield, quality and grade composition, and chemistry (16). Such action is strongly supported by the China National Tobacco Corporation. A substitute style of flue-cured and burley leaf of suitable quality for inclusion in international brands has also been achieved in a similar manner in Turkey (16).

2) Modification of the grading system and pricing policy

The farmers in Canada commenced a conscientious effort to improve the maturity level of their flue-cured crop, by implementing a new grading system, agreed between the buyers and themselves, in 1987. Emphasis was placed on the production of mature leaf and darker colours. Higher minimum grade prices were offered for such tobaccos. This has been very successful.

Similar procedures can be taken where leaf is contracted or purchased by a Government agency. Thus, Campbell et al. recommended such action in a rehabilitation review

of the tobacco industry of Tanzania in 1983, in order to encourage farmers to produce better quality tobacco and thereby obtain higher prices (6).

b) Leaf purchase

Tobacco manufacturers, notably those importing leaf, annually review crop prospects prior to opening sales on a worldwide basis. Samples may be collected for subjective assessment and chemical analysis. Many buyer representatives, particularly for export, place emphasis on smoking tests. All countries have a different consumer smoke requirement, so it is important to recognise the leaf style, which would suit each customer.

The Leaf Buying Manager and the Chief Manufacturing Blender must be continually aware of grade shortages, as the market proceeds. There may be a need to make satisfactory leaf substitutions of near equivalent smoke taste and price. This is perhaps of greater significance to manufacturers buying from a range of countries. A leaf usability index may be developed for each country and this, together with price, may determine if and where a shift or interchangeability in purchase becomes necessary. Price will not only include the basic leaf cost and lamina yield, but also the buying, threshing and packing cost, the hog-shead or case material cost, the freight cost, together with any export subsidies or taxes.

c) Green leaf processing

The act of buying is obviously still important to meet customer desires and it is where the money is spent on the raw product. Emphasis on quantitative specifications for manufacture has become equally important and hence green leaf processing plays a key part in leaf supply.

Leaf purchases, on receipt from the auction market, or even in direct selling, may be regraded according to the company's own criteria. Blend mixtures for the customer/manufacturer are developed at this point and/or at the bulk feeder or staging area prior to threshing. These are key positions of blending. The Chief Regrader or Leaf Quality Control Supervisor, together with a Leaf Buying Supervisor and the Customer will together make certain that the blends are acceptable. The Customer will watch these positions continuously and will review his threshed tobacco after packaging. Feedback and grade changes can be made to the buyer as necessary.

Threshing standards of lamina particle size, stem in lamina, and objectionable stem have become stricter over the years to meet manufacturing requirements particularly as the speed of cigarette making equipment has increased. Emphasis on producing the highest percentage of lamina particles over 13 mm. led to the introduction, a few years

ago, of soft threshing (4). The flow rate of whole leaf is decreased in order to increase lamina size and its amount. A major objective of every tobacco processor is the minimisation of degradation at every phase of operations and to reduce handling and transfer to a minimum. The level of fines is correspondingly minimised.

Customers are provided with results of sample tests at least twice an hour, to ensure that they are acceptable to their specifications. Unfortunately, testing procedures in the past have not been fully standardised by company. Some manufacturers have, therefore, been auditing their suppliers' lamina and stem products.

In 1989, a Stemmy Quality Assurance Standardization Committee, composed of U.S. and foreign manufacturers and leaf dealers agreed to a standardized definition of particle or strip size, objectionable stem and stem in lamina, and packing moisture; to procedures measuring them; and to equipment to carry this out. These were approved by CORESTA in October 1990 (19). It is hoped that such methods will become standard for all green leaf processing companies worldwide. Then all results should become comparable.

In most green leaf processing factories, bulking silos have been installed between the threshing and drying machinery. Moisture variation is improved allowing tighter specifications in redrying. Equally the blending of chemistry levels in the strips ensures minimal testing. Indeed, it has been found that nicotine levels, throughout lots of 9,000-18,000 kg. test to within ± 0.1 per cent. Some companies believe that lamina degradation may occur, but this is probably due to overfeeding the silo and holding the lamina in it for too long a period. Most people feel that the benefits of siloing, moisture variation reduction and chemical blending, outweigh any particle degradation.

Thus the flue-cured and air-cured dried lamina provided to the manufacturer has the following specifications:

- acceptable looks and smoke properties
- accurate chemistry and moisture determinations
- specified lamina particle size and stem content
- minimal foreign matter, suckers and sand
- acceptable price

Depending on the customer, other determinations may be provided petroleum ether extract, total volatile bases, total nitrogen, chlorine content, pesticide residues.

Future

There have been a number of political and economic changes, during the past few years, which will have an effect on the type of cigarette smoked in the future and in turn on the type of leaf, its usability and price, produced for, or incorporated in, such cigarettes namely:

- The emergence of tobacco markets in Eastern Europe and the former Soviet Union Republics, now open to cigarette and factory upgrading by western tobacco manufacturers. The market for quality made cigarettes is enormous, but the ability cashwise to purchase both them and good usable imported leaf is low in many places. As a result customers are not particularly discriminating in taste. The type of leaf imported at the present time is dictated by price.
- Consumption of cigarettes is likely to slowly decrease in the European Community (EC 12). Customers are very discriminating in taste, but the type of cigarette may change in some member countries to meet the 15 mg. cigarette directive starting in 1993, and the 12 mg. directive in 1998. This may also affect what leaf type is grown there (10)
- Consumers have become very price conscious in the past few years in the U.S.A. and Western Europe, leading to an enormous growth of price-value, generic or discount cigarette brands. This has resulted in manufacturer review of blend make-up, the inclusion of lower cost leaf, the level of reconstituted sheet or cut rolled stem, together with filters and paper, and overall manufacturing costs. The price gap between full-value and generic cigarettes therefore demands a study of the price differential and usability of leaf from all sources, while maintaining consumer satisfaction. The need for the farmer everywhere to be aware of changes in requirements is paramount.
- Trade liberalisation under the GATT rules is still under consideration in the Uruguay Round. While it is desirable, it would have the effect of lowering tobacco prices in world markets and significantly affecting the market (12). Equally, any reform in the E.C. Common Agricultural Policy in relation to quotas, price supports and subsidies to tobacco farmers will have major effects too (10). The new requirement of controlled usage of locally produced leaf in cigarettes in the U.S.A. (the 75 per cent rule) may protect the farmer in the short term but is obviously against GATT rules, and will affect the level and amount of tobacco types imported.

Leaf production by the farmer and purchase by the buyer

Whatever the outcome of these changes, the smoker will continue to demand a quality manufactured cigarette, with an acceptable taste, at a competitive price. There will be continual differences in blends of some brands to suit country preferences, each containing the appropriate mix of leaf types. But, as has been stated, there are definite signs of a shift to American blend and light cigarettes in many countries, with flue-cured Virginia cigarettes holding their own, and with a lower demand for dark air

cigarettes (12). This will affect what leaf types need to be produced or imported.

It is strongly believed, however, that the crop management techniques currently associated with leaf production and marketing by the farmer (9) and the bases on which the buyer makes his leaf assessment (8) will continue. This applies to all tobacco types, flue, burley, light and dark air, and oriental. The characteristics of ripe or mature leaf; harvested and marketed in at least 3-4 plant positions; with a good, often darker, leaf colour; with acceptable chemistry and smoke taste, together with good manufacturing usability; at a competitive price; are what is wanted by the buyer. For oriental and semi-oriental types, aroma is also a key characteristic.

Agronomic research must be continued. CHAPLIN (11) has emphasised the essential need for practical applied research for the farmer, rather than long term basic research. Regionalising or internationalising such research should be considered because of reduced availability of funds. Variety development, fertiliser management, mechanisation and curing, have made major contributions to maintaining cultivation standards and reducing costs in the past thirty years. The need to protect and improve the environment is of special importance, for example, more economic use of fertilisers, integrated pest management, improved pesticide use, control of erosion, continued emphasis on rotations, improved and decreased fuel use for curing, notably coal and wood. The importance of communicating results of such research to farmers through extension is vital.

In conclusion, it is obvious that major industry changes will occur in the future, often as a result of government edicts, regulations and taxing, throughout the world. Tobacco is an important international crop and manufactured product and will continue to be so. There will be greater emphasis on objectivity in leaf usability. Farmer and buyer communication is highly desirable. As they have done in the past, the buyers and manufacturers everywhere will meet the challenges of such changes, but they should ensure that their pricing structure encourages the production of appropriate styles of usable leaf for their products and consumers.

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