CHEMICAL CHARACTERIZATION OF SOME TOBACCO TYPES GROWN IN EGYPT

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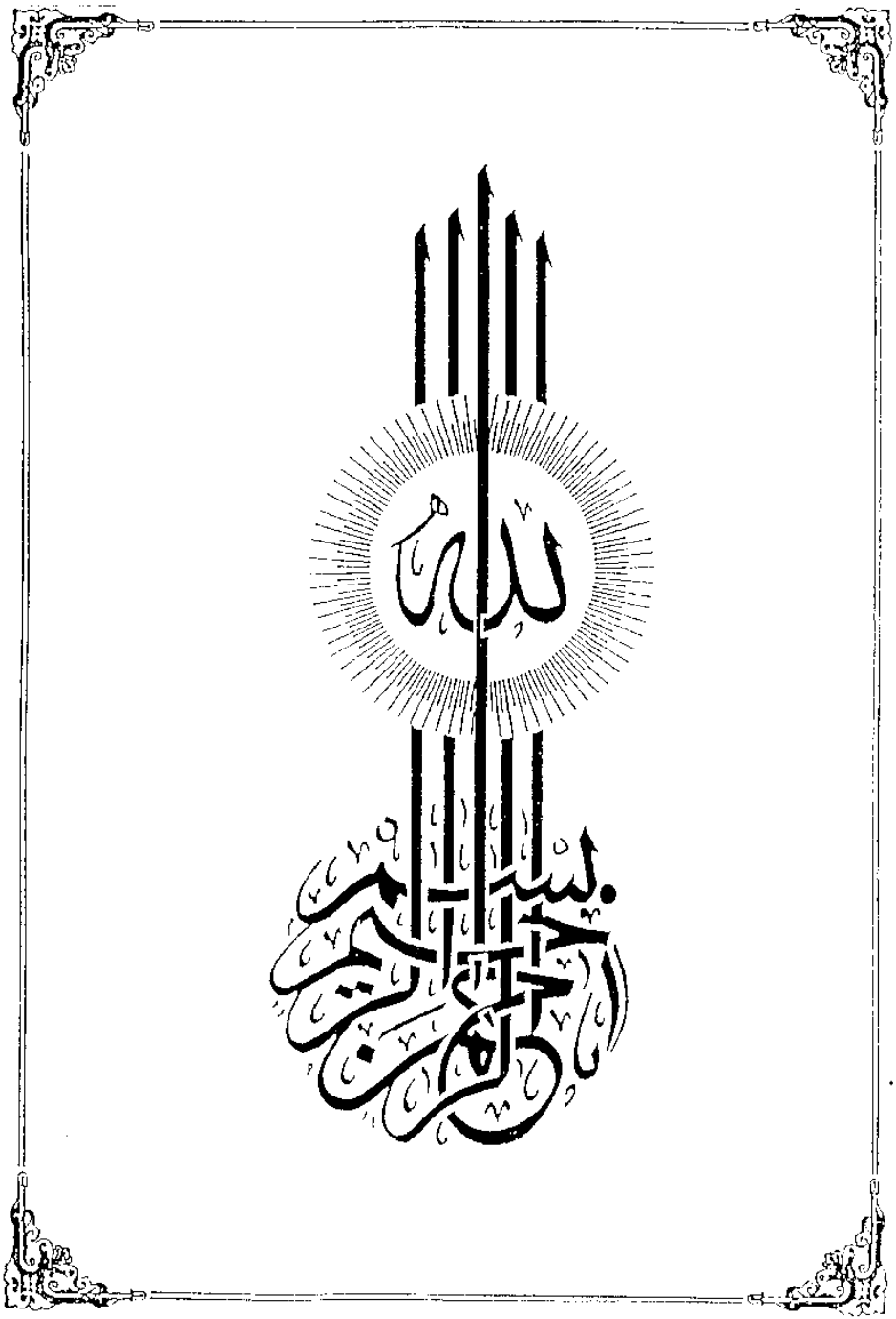

CONTENTS

INTRODUCTION

Tobacco is a member of Solanaceae family. Extensive cultivation of tobacco was first started by Spananiards in their American colonies around 1530. The tobacco plant was introduced into the countries of Europe, China, Japan, South Africa and many other countries.

Now, about 42 species related to genus Nicotiana are known, but only two species of them are being grown for smoking, chewing tobacco and snuff, namely N. tabaccum and N. rustica. Special strains of N. tabaccum had been developed during the past three and half centuries of tobacco cultivation. Burley and Virginian are two of them; they are primarily cigarette tobacco, though they are used in chewing tobacco and Pipe mixtures.

Since plant matures from the bottom to the top, the grower who cures the entire plant, harvest his crop when the bottom leaves are usually over ripe and the top leaves are less mature. Thus, part of the crop is lost and that can't be controlled on the basis that this procedure may not save some leaves that would otherwise be destroyed. In addition, the grower uses the process of flue curing to cure Virginian type and this process is expensive as price of energy sources gas or electricity and it is not economically for him.

Priming of the leaves enables the grower to harvest the leaves at the optimum degree of ripeness and this permits the remaining upper leaves to continue their maturity. Priming also prevents the loss of the bottom leaves.

Costs of flue cured tobacco production increase markedly and consistently. The process of flue curing becomes rather expensive as price of energy sources gas or electricity- is relatively higher - thus air cured process was carried out to indicate the quality and what is the different between air and flue cured.

In A.R.E., tobacco production in commercial scale is forbiden, except for research purposes and economic studies, aspecial permission could be obtained.

This work was designed to study the effect of the harvest on the chemical composition of cured Burley tobacco leaves. Also, present study aims to detect the induced changes in the chemical composition of Virginian tobacco leaf as influenced by both methods of curing (air curing and flue curing). Also, the effect of leaf position on the plant stalk. The interaction between method of curing and leaf position were taken into consideration.

REVIEW OF LITERATURE

1- Effect of harvesting procedures :

For stalk- cutting the choice is between lossing some bottom leaves or at least deteriorating their quality, or lowering the quality of the upper ones. Another alternative, is to prime the crop. Was the target of several investigators.

Young and Jeffery (1943), reported that proteolysis occurred in the leaf of cut- stalk plant gives rise to soluble nitrogen compounds. The small increase in the amino acid nitrogen is quite insufficient to be account for the scale of protein breakdown. They further added that there were some deamination to free ammonia. About 70 % of total amino acids in the cured Burley, leaves have been identified as amino acid amides.

Vickery and Meiss (1953), found that much of the loss of the total nitrogen in the air-curing process is likely to be through volatilization of ammonia. They also stated that, about half of the cell proteins disappeared from air cured primed leaves in the first six days of curing, but they alter little thereafter .

Burton and Wright (1961) , found that leaves of plant cut by stalk, contained low proportion of nicotine and

protein nitrogen, whereas, the proportion of soluble nitrogen, ammonia, and ash were increased. On the other hand, detachment of leaves (priming), resulted in a greater stability of nicotine, protein nitrogen and higher concentration of soluble nitrogen and ammonia. They also added that, potash and alkalinity of water soluble ash were highest in the leaves which were harvested by priming in the lower part of the plant, whereas, the lowest values were found in the unprimed portion. Potassium migrates from the lower leaves to the upper leaves during the later stages of growth of the unprimed plants.

In an extensive study Atkinson (1963), made a comparison between cut- stalk and primed Burley tobacco. He found that detached leaves were significantly heavier after curing than those cured attached to the stalk. Moreover , higher concentrations of total nitrogen and ammonia were found in primed leaf, but, potassium and alkalinity of the water soluble ash were not significantly affected .Total alkaloids, protein, nitrogen and total ash varied with respect to leaf position. Average moisture holding capacity was slightly higher for-primed leaf.

In another investigation Kitano and Tanaka (1970), compared two methods of harvesting, i.e., cut - stalk and

priming. They found that the concentration of nitrogen compounds in leaf of Burley tobacco were highest in primed leaves. The concentration of total volatile bases and total alkaloids were higher in leaves of cut-stalk plants than those of the primed leaves.

In continuation to the previous work, Dettang et al. (1971), reported that nicotine content was averaged 0.85 % and 0.73 % in primed leaves and midribs of burley tobacco respectively, whereas increased to 1.97 % and 1.92 % in the leaves and midribs of cut- stalk Burley tobacco. The nitrogen content in the leaf of the cut- stalk plant was as much as 57 % of those in the primed leaves.

In Egypt, El- Gamal (1975), compared two methods for harvesting of Burley tobacco, i.e. the normal cut- stalk and priming method. He found that, lower nitrogen and potassium percentages when cut- stalk method was followed than that of priming method. The cut- stalk method gave greater nicotine and chlorine percentages than those of the primed leaves.

Hamilton (1975), reported that ammonia released during the first few days of cut- stalk curing. Then, the leaves utilized ammonia in the formation of amides.

Later, Azimi Hosseiny (1977), evaluated the effect of three different harvesting procedures on some chemical characteristics of air- curred Burley tobacco. He found that,

ordinary priming treatments increased nicotine concentration and combustability properties, but decreased sugar content. On the other hand, stalk cutting treatment increased grade index and decreased nicotine content. Sugar and combustability properties of stalk cutting were the same as priming treatment.

2- Effect of stalk position :

The differences in chemical composition among leaves from various stalk positions were thoroughly investigated by several workers.

The chemical composition of flue- cured tobacco according to various positions were reported by Darkis et al., (1936), they showed that, alfa-amino nitrogen and water soluble nitrogen fractions were low in the leaves at the center of the stalk and high in both bottom and upper positions . Total sugar behaved in the opposite trend.

The variation in chemical composition of cured leaves according to their position on the stalk was early reported by Hanmer et al., (1940). They found that, total ash content in the lower leaves was twice that at the top. The a amounts of calcium and magnesium, particularly were high at the bottom. Potassium decreased regularly upwards. Acidity steadily increased up the plant (pH 6.79- 5.31). Total nitrogen

markedly increased up the plant till near the top then it declined slightly. Nicotine content reached a maximum about $\frac{3}{4}$ of the way up the plant. Protein increased gently upwards the plant. The ammonia content rose very steeply from the bottom to the top of the plant.

Moseley et al. (1951), showed a different pattern of distribution of nitrogen fractions. The alfa amino nitrogen, total nitrogen and ammonia nitrogen increased as the stalk position ascended.

The chemical analysis done by Bortner et al. (1960), on flue- cured tobacco leaves exhibited that ammonia and amid nitrogen increased steadily up the plant. Also, asparagine and aspartic acids were the most predominate amino acids in burley and much exceed their respective contents in flue cured tobacco.

The results obtained by Hondt (1962), on both burley and maryland tobacco (air- cured types), showed that total nitrogen increased slowly up the plant. Nicotine contents increased to the middle of the plant and then the increase was a little and reduced in the top. Total ash and calcium reduced from the bottom to the top of the plant. Potassium was more evenly distributed with some decline in the leaves and top grades.

Kameswararao et al.,(1964), reported that chloride ions are readily absorbed by tobacco plants and in general, chloride concentration in plant increases with its availability to roots. Also, they added that chloride concentration generally, is higher in the lower leaves.

Moseley (1967), indicated a transport of nutrients; nitrogen, phosphorus and potassium from senescence leaves, while accumulation of calcium were detected. On the other hand, top leaves were characterized by meristematic activity with larger amounts of phosphorus, as a constituent of the nucleic acids which show substantial activities.

Bowman and Nichols (1968), reported that total nitrogen percentage increased with leaf grade from the bottom to the top of the plant. The nicotine content increased from the bottom towards the top of the plant,as far as, the fourth grade, then decreased in the fifth grade. There was little variation in potassium percent among tobacco grades. The lower leaves contained the most calcium while the upper leaves contained the least.

Hsup and Shieh (1970), reported that leaves of tobacco plants in the middle position had a lower content of total nitrogen and higher contents of reducing sugar than leaves

at other positions. The leaves of mid position also had an intermidiate content of total volatile bases and alkaloids. Leaves near the growing points had relatively higher total nitrogen content, whereas, those at the bases had lower contents of chemical constituents.

The studies of Nel et al. (1975), revealed that sugars, lamina and moisture equilibrium increased linearly while total nitrogen, filling power and ash decreased with ascending leaf position on the plant.

Elliot (1978), studied the distribution of certain minor elements in Canadian flue- cured tobacco, he found that magnesium decreased from bottom to the top of the plant (0.87- 0.38 %).

In another view, Hirane et al., (1978), revealed that the contents of total alkaloids increased in the leaves of the upper stalk position.

In Egypt, Oweida et al., (1979), found that the total nitrogen content in the leaf of Burley tobacco plant increased steadily from the bottom up to the top of the plant . Nicotine content increased till the mid of the plant, then a slight decrease was observed. They also added that the leaf at the bottom had the greatest concentrations of potassium and

chloride. However, no apparent differences between the middle and the top leaves were noted.

Akehurst (1981), reported that, in flue- cured tobacco plants, the total nitrogen tended to increase steadily from the bottom to the top in different geographical areas (U.S.A., Canada, India and Zimbabwi). Alpha amino nitrogen was higher at the top than at the bottom. Nicotine was fairly uniform in the lower part of the plant but rises gradually from the middle to the top. High total sugar contents were usually in the cutters (near the basic third of the stalk) with a fairly marked drop in the lugs (near the base of the stalk), and a less pronounced decline upwards to the top . Potassium and calcium, generally, decreased gently from bottom to the top of the plant. There was a slight but , steady decrease in pH from bottom to the top. Chloride content was increased in the lugs and then decreased considerably and abruptly to alter little in the top of the plant.

In a recent research, Ortiz and Oliero (1982), indicated that the chloride, ash, potassium and alkalinity of water soluble ash contents of Burley tobacco decreased , whereas polyphenols and calcium contents increased with the increase in plant height. Magnesium reached a minimum while burning rate a maximum in the middle of the stalk.

3- Effect of location :

The interaction of soil with climate is vital on tobacco leaf contents. Fortunately , this aspect is somewhat simplified in our study since differences in climate localities in Egypt is negligible. Responsibility for differences in the leaf position is thus mainly fall upon chemical and physical properties of the soil.

However, the literature abounds with observations on these effects. Darkis et al. (1935), produced a detailed analysis of U.S.A. tobaccos. They could distingush real chemical differences among the categories. Type 14 (Georgia) which was higher in sugar (23 %), had a higher proportion of soluble nitrogen and a moderate nicotine (2-5 %). Type 13 (South Carolina) had less sugar content (20%), a low proportion of soluble nitrogen and the lowest nicotine at (2.36) percent. Type 12 (Eastern North Carolina) had less sugar content (19 %), the lowest proportion of soluble nitrogen and a moderate nicotine content (2.57 %).

In Egypt, Salem et al. (1965), reported that, tobacco produced in clay soil at Giza was associated with poor burning whereas, those grown in calcarious soil of Nubaria had the better burning quality.

In further experiment Sheen et al.,(1968), made a survey of the chemical constituents of Nicotiana tabaccum,