STUDY ON TOBACCO QUALITY OF VIRGINIA VARIETY GROUP GROWN IN BULGARIA
TECHNOLOGICAL STUDY ON THE QUALITY OF VIRGINIA TOBACCO INTRODUCED VARIETIES GROWN IN THE DISTRICTS OF SOUTH BULGARIA (PART I)

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ABSTRACT
The forthcoming integration of Bulgaria to the European Union has laid to the tobacco producers the need of increasing the tobacco quality of Virginia variety group. Implementation of introduced varieties aims at increasing the quality and maintaining the manufacture in compliance with demands of raw stuff of defined quality features. The purpose of the study was to perform technological studies on the major quality indicators of Virginia introduced varieties compared to the tobaccos of the same variety group mass grown in the areas of South Bulgaria. The analysis and valuation in comparing of the check varieties with the introduced ones was performed on the basis of the objective and subjective indicators, describing the quality, applied in our country. The final valuation with view of demonstration of a possible higher quality or vice versa, was based on a complex valuation. The summary of the results demonstrates that it is reasonable to extend the area of application of the introduced varieties K394 and PVH19, whereas it cannot be expected any deterioration of the variety composition, but rather the reverse – the same is more likely to become better.

Introduction
The forthcoming integration of Bulgaria to the European Union has laid to the tobacco producers the need of increasing the tobacco quality of Virginia variety group. The principles of market contracting between farmers and traders have imposed the study and differentiation of Virginia tobacco quality with the existing variety structure, as well as introduction of new ones. Another obligatory component of the contracts anticipated to be signed between producers or associations (groups) of farmers and the licensed tobacco processing companies, along with a number of requirements to quantity, quality etc., is the purchase price. Determination of the prices at market contracting requires that the price should be adequate to the quality, which in turn provides producers with certain profitability.

Implementation of introduced varieties aims at increasing the quality and maintaining the manufacture in compliance with...
demands of raw stuff of defined quality features. As a high flexible plant under the impact of various climate conditions, terrain, soil variety, sort and agricultural equipment applied within the general description of tobacco, quality variations are obtained that differ it from the major type. For years a group of varieties have been adapting to the conditions of the district and produced tobaccos of similar characteristics and properties. As a result from their adequate combination tobacco has developed as a differentiated technological product of certain original properties (5). In this relation, it is necessary to make a study on their quality potential under the environmental conditions within the growing area in our country, with view of achievement of favourable combination of the obtained tobacco qualities with the technological and smoking properties, as desired by the consumers.

The purpose of the study was to perform technological studies on the major quality indicators of Virginia introduced varieties compared to the tobaccos of the same variety group mass grown in the areas of South Bulgaria.

Materials and Methods

This study refers to crop 2004. The areas where new varieties were being grown were, as follows:
- Parvomay /Debar/ - at two check samples V0454 and V0514 and introduced variety K394.
- Parvomay /Dalbok Izvor/ - at check sample V0454 and two introduced varieties: K394 and PVH19.

The tobacco growing was performed with the agricultural equipment applied in the corresponding areas. The technological conditions were the same both for the sample variety / varieties and for the tested ones.

For the purposes of this study there were produced trials of the most characteristic of the highest quality/ gathering belt – “C”, both from the check samples and from the experimental tobaccos.

The trials of the corresponding areas had been previously precised (unified) with view of including one and the same material of the check samples and the introduced varieties for investigation.

The study was made in reference with the major quality indicators:

**Physical Indicators**
- length, cm
- width, cm
- ratio length/width,
- thickness of the leaf blade, mm
- cut tobacco density, g/cm³

Well-known routine methods were applied.

**Chemical Tobacco Indicators**
- nicotine, % - by ISO 15152;
- reduced sugars, % - by ISO 15154;
- total nitrogen, % - by BDS 15836-88;
- mineral composition (ashes), % - by ISO 2817
- potassium, % – BDS 17365-94
- hexane extraction, % – TTPI by “SOXTEC”
- chlorine, % - by the Method for Analysis in Continuous Flow – TTPI /1999/.
- ratio reduced sugars/nicotine
- ratio total nitrogen/nicotine (Tso number)

**Tobacco Smoke Chemical Indicators**
- nicotine, mg/cig
- tars, mg/cig

These indicators were calculated on the basis of established regressive dependencies between tobacco composition and tobacco smoke (4).

“Image photographing” of the varieties

It was performed a spectro-photometric determination of the discrete absorption values of water extraction from tobacco within the range between 220 – 350 nm wave length.

**Expert’s valuation**

It was made through comparison ‘by pairs’
of the check and experimental samples and then the latter were arranged by preference based on the complex valuation of the quality indicators for the type. In cases when one check sample was compared to two experimental or vice versa it was made by combining pairs, then at the second stage the three samples were compared directly. The final valuation was made by the sum of the ranks that each relevant sample has obtained.

For a better sample was considered that whose sum of ranks was smaller. The check up for trustworthiness of the obtained results was made through determination of the homogeneous factor of Kohen.

**Taste valuation**

It was performed by puffing the cigarettes by the ‘Method of Pairs’. Grading them by preference was based on the complex valuation of the smoking properties – taste, flavour, and strength. The final valuation represents a sum of the ranks. For a better sample was considered that whose sum of ranks was smaller. The valuation for agreement of the results of all of the board, trustworthiness was determined by the Cendal criterion, respectively.

**Complex valuation**

A complex valuation was made by arrangement of the samples by major indicators featuring the quality at different factors of importance thereto. The final result from the valuation of the introduced and check varieties is expressed by the values of the quality index. Its smaller values correspond to a higher quality level of the tested sample and vice versa (3).

### Results and Discussion

The analysis and valuation in comparing of the check varieties with the introduced ones was performed on the basis of the objective and subjective indicators, describing the quality, applied in our country. The final valuation with view of demonstration of a possible higher quality or vice versa, was based on a complex valuation.

The results obtained for the physical indicators of the tobaccos under investigation are placed in Table 1.
The results related to the chemical composition of the investigated tobaccos are placed in Table 2.

**Nicotine.** It is well known that the typical Virginia type tobaccos must possess nicotine over 2.0-2.5% (1, 2). The introduced variety K394 shows a higher value for the district of Pazardzhik /Kap. Dimitrievo/ (2.19%) compared to the two check varieties rather than for the rest of the two areas of Pazardzhik /Kap. Dimitrievo/ and Parvomay /Dalbok Izvor/ where it has less values than the check sample.

Variety PVH19 possesses definitely a higher value (2.22%) for the area of Pazardzhik /Kap. Dimitrievo/ rather than for the district of Parvomay /Dalbok Izvor/ where the same variety has a less value (1.22%) compared to the check sample V0454 and the experimental K394.

The above results demonstrate that it cannot be drawn any unconditional conclusion about higher or lower nicotine content between the compared varieties.

**Reducing sugars:** There are no convincing differences between the samples, except for the case with the introduced variety K394 of the district of Parvomay /Debar/ where the values are lower and for the district of Pazardzhik /Kap. Dimitrievo/ for the variety PVH19 – lower values. In general, the content of the reducing sugars in the tobaccos under investigation is high.

**Reducing sugars/nicotine.** This ratio featuring the predominance of the reducing sugars to nicotine demonstrates that it has higher values with the introduced varieties, which is not an advantage, except for variety PVH19 of the area of Pazardzhik /Kap. Dimitrievo/ and variety K394 of the area of Parvomay /Debar/. With the check varieties this ratio also has high values.

**Total nitrogen ads ratio Total nitrogen/nicotine.** The most characteristic indicator for the quality of the Virginia type is the ratio of total nitrogen/nicotine (Tso number) (6). The typical tobaccos of Virginia type must have values of such ratio within 0.6 - 1.

Comparing the check varieties with the experimental ones no clearly expressed trend has been outlined. Variety K394 has higher values in this relation of the introduced varieties. In separate cases Tso number has values under 1, but generally the values are over 1. It has lower values for variety PVH19 and the check V0454 of the red samples.
Fig. 1. Absorption specters for district Pazardzhik /Kap. Dimitrievo/.

The content of total nitrogen taken alone is not sufficiently a typical indicator for quality. Ashes. No definite conclusions can be drawn with regard to the content of ashes.

Potassium and chlorine. The content of potassium and chlorine is to be considered in reference with their impact on burning ability. The results, in general, show low level of chlorine content, which is favorable. An exception of it is established for the area of Parvomay /Debar/ where the chlorine content is higher than the rest of the areas reaching to 0.94%. The potassium content varies within close limits, as there cannot be established any differences between the check samples and the experimental.

Nicotine in tobacco smoke. The nicotine in the tobacco smoke with the different samples changes by analogy with the nicotine in tobacco. Therefore, the conclusions for the nicotine in tobacco are also valid for the nicotine in smoke.

Tars. The hexane extraction as well as the potassium represents the basic parameters in the calculation of the tar content in the tobacco smoke.

Compared to the check varieties the experimental K394 has no lower values, except for the areas of Parvomay /Dalbok Izvor /18.42%/.

For PVH19 it can be said the same, since when comparing the values of the tars they are either equal or higher /in one case they are equal and in another – higher/. In the end, the general prevailing conclusion is that there are no significant differences between the newly introduced varieties and the check ones.

“Image photographing” of the samples. The method of “Image photographing” is a complex indicator describing tobacco. As an objective indicator it may explicitly serve as comparison between the extent of ‘correspondence’ and/or ‘difference’ between a sample taken as reference /check sample/ and another one as experimental. The closer the discrete absorption values of the experimental sample according to the reference, the closer the general nature in quality aspect is. In fact it is not possible to have complete coincidence because the samples differ genetically. By ‘Image photographing’ we establish the extent of ‘identity’ or ‘difference’. The obtained results are, as follows:

District of Pazardzhik /Kap. Dimitrievo/ (Fig. 1). For the district of Pazardzhik the experimental sample K394 is closer to the check V0454. In the preceding range (up to 280 nm) all three tobacco varieties are very close. We can say that the difference is more
District of Parvomay /Debar/ (Fig. 2). The result for this district shows complete coincidence of the general nature of quality between both checks V0454 and V0514, and a certain difference with the introduced variety K394. In this case we cannot draw any conclusions about the obtained absorption values for quality level, but it is obvious that the introduced variety differs from both checks.

District of Parvomay /Dalbok Izvor/ (Fig. 3). For this district by the investigated indicator it is established almost complete coincidence of the spectral curve for the experimental samples /K394 and PVH19/ and significant deviation of the curve of the check variety. In this case for this district the general nature of the quality of the experimental samples is to be the same. On the condition that by the rest of the investigated indicators the experimental samples are better than the check, no matter which of the two varieties is more suitable for this district.

The general nature of the obtained spectral curves for the investigated tobaccos can be grouped in two ways: First – when the curves move in parallel to one another and Second – when there is overlapping of the curves regardless of where it is /up or down/, before or after 280 nm.

**Expert’s valuation**
The results from the expert’s valuation are
placed in Table 3.

They demonstrate different grading of the samples from the separate districts in the sense that in some cases the check sample appears of higher quality with regard to the outer signs and expert’s valuation, and in other in reverse – the introduced varieties. The results in particular are, as follows:

**District of Pazardzhik /Kap. Dimitrievo/.
 Variety PVH19, followed by K394 have the best outer signs of quality, i.e. the experimental samples are of better quality indicators compared to the check for this district.

**District of Parvomay /Debar/.
 In this case both check samples are of better indicators compared to the experimental variety K394. When comparing them variety V0454 proves to be of better outer signs.

**District of Parvomay /Dalbok Izvor/.
 The introduced variety K394 has the best valuation, followed by the check sample V0454, and PVH19 is last.

Therefore on the basis of the expert’s valuation it is confirmed the fact that depending on the genetic peculiarities of the variety and the district of growing, tobacco makes a different quality, which in turn draws the conclusion that the approach to deciding on the introduction of the relevant variety should be differentiated.

**Taste valuation**

The results from the taste valuation are presented in Table 3.

**District of Pazardzhik /Kap. Dimitrievo/.
 There are no differences, if compared by pairs, between the check sample and the experimental, with the underlined difference between both experimental samples – PVH19 has better smoking properties.

**District of Parvomay /Debar/.
 There is no difference between the check varieties, as well as between the experimental sample and both checks.

**District of Parvomay /Dalbok Izvor/.
 In the comparison it is outlined only the better smoking properties for PVH19 than the check variety V0454. In the rest of the cases when comparing the check with K394, as well as between the two experimental varieties, there are no differences established.

The results from the taste valuation show various ranging between the check samples and the experimental ones for the different districts, i.e. lack of one direction of the valuation for preference, better or worse smoking properties between the tested samples, except for PVH19, which is placed first in both cases.

The general conclusion resulting from

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**TABLE 3**

**Table:** Expert’s and taste valuation

<table>
<thead>
<tr>
<th>District</th>
<th>Sample</th>
<th>EXPERT’S VALUATION</th>
<th>TASTE VALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sum of the ranks when compared by pairs</td>
<td>Sum of the ranks when compared directly</td>
</tr>
<tr>
<td>Pazardzhik</td>
<td>Check-V0454</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Kap. Dimitrievo/</td>
<td>K394</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>PVH19</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Parvomay</td>
<td>Check-V0454</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>/Debar/</td>
<td>Check-V0514</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>K394</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Parvomay</td>
<td>Check-V0454</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>/Dalbok Izvor/</td>
<td>K394</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>PVH19</td>
<td>12</td>
<td>18</td>
</tr>
</tbody>
</table>
TABLE 4

Complex valuation District Pazardzhik /Kap. Dimitrievo/

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Ranging of samples</th>
<th>Figure of importance</th>
<th>Quality index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V0454</td>
<td>K394</td>
<td>PVH19</td>
</tr>
<tr>
<td>1. Tars Ranging</td>
<td>18.43</td>
<td>18.36</td>
<td>22.99</td>
</tr>
<tr>
<td>2. Red. Sugars/nicotine</td>
<td>19.61</td>
<td>28.11</td>
<td>9.28</td>
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<tr>
<td>Ranging</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3. Total nitrogen/nicotine</td>
<td>0.95</td>
<td>1.21</td>
<td>0.78</td>
</tr>
<tr>
<td>Ranging</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4. Specific volume</td>
<td>4.26</td>
<td>4.85</td>
<td>4.26</td>
</tr>
<tr>
<td>Ranging</td>
<td>2.5</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>5. Expert's valuation</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6. Tasting</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2.20</td>
<td>2.25</td>
<td>1.55</td>
</tr>
</tbody>
</table>

The taste valuation confirms the above with regard to the expert’s valuation, i.e. the valuation approach should be differentiated in the different districts with regard to the tobacco varieties grown there.

On the grounds of the obtained results, for sum of the ranks, if compared by pairs, we have made a general grading between the check samples and the experimental, with view of comparing the results with the expert’s valuation.

When comparing the results between the expert’s valuation and the taste valuation, i.e. when applying the subjective quality assessment methods, there is no unidirectional sample valuation established. It results from the fact that the correlation between the outer quality signs and the smoking properties is not clearly expressed in all cases. Fro the point of view of the producers the expert’s valuation is of more significant importance, while for the cigarette production it is the reverse – the tasting is prevailing in this aspect. To introduce the varieties in one district or other, the valuation by commercial classes, based on the expert’s review, should be considered.

**Complex valuation**

Due to the versatile results, obtained in the separate districts, as stated above, the complex valuation of the varieties with regard to the major quality indicators subject to investigation is to be presented separately for the different districts. It is absolutely logic, because as you know, the formation of definite quality properties of given tobacco is under the influence of the genetic factor, ecological, climate conditions and the applied agricultural equipment.

The results from the complex valuation are presented in Tables 4 – 6 and are, as follows:

**District of Pazardzhik /Kap. Dimitrievo/**

PVH19 is the best, followed by the check V0454 and finally the experimental sample К394, as the difference between the last ones is insignificant.

**District of Parvomay /Debar/**

The experimental sample K394 is the best, followed by the two checks, as V0514 of them is better, at more insignificant differences between the compared samples.

**District of Parvomay /Dalbok Izvor/**

The experimental sample K394 is the best, followed by the two checks, as V0514 of them is better, at more insignificant differences between the compared samples.

The general conclusions from the complex valuation of the varieties demonstrate...
TABLE 5

<table>
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<tbody>
<tr>
<td></td>
<td>V0454</td>
<td>V0514</td>
<td>K394</td>
</tr>
<tr>
<td>1. Tars Ranging</td>
<td>18.52</td>
<td>18.61</td>
<td>20.32</td>
</tr>
<tr>
<td>2. Red. Sugars/nicotine Ranging</td>
<td>28.70</td>
<td>26.20</td>
<td>8.77</td>
</tr>
<tr>
<td>3. Total nitrogen/nicotine Ranging</td>
<td>1.45</td>
<td>1.42</td>
<td>0.78</td>
</tr>
<tr>
<td>4. Specific volume Ranging</td>
<td>3.68</td>
<td>4.24</td>
<td>4.90</td>
</tr>
<tr>
<td>5. Expert's valuation</td>
<td>1.00</td>
<td>2.00</td>
<td>3.00</td>
</tr>
<tr>
<td>6. Tasting</td>
<td>2.00</td>
<td>2.00</td>
<td>3.00</td>
</tr>
</tbody>
</table>

TABLE 6

<table>
<thead>
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</tr>
<tr>
<td>1. Tars Ranging</td>
<td>18.00</td>
<td>18.42</td>
<td>18.49</td>
</tr>
<tr>
<td>2. Red. Sugars/nicotine Ranging</td>
<td>15.79</td>
<td>17.79</td>
<td>19.75</td>
</tr>
<tr>
<td>3. Total nitrogen/nicotine Ranging</td>
<td>1.01</td>
<td>1.14</td>
<td>1.09</td>
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<tr>
<td>4. Specific volume Ranging</td>
<td>4.50</td>
<td>4.33</td>
<td>3.33</td>
</tr>
<tr>
<td>5. Expert's valuation</td>
<td>2.00</td>
<td>1.50</td>
<td>3.00</td>
</tr>
<tr>
<td>6. Tasting</td>
<td>3.00</td>
<td>2.00</td>
<td>1.50</td>
</tr>
</tbody>
</table>

a trend towards better quality indicators for the experimental samples, as in certain districts in the comparison between the experimental varieties PVH19 is better for the district of Pazardzhik /Kap. Dimitrievo/, and K394 is better for the districts of Parvomay /Debar/ and Parvomay /Dalbok Izvor/.

Conclusions
The studies about the technological valuation for the quality of the introduced tobacco varieties of Virginia type make us draw the following general conclusions:
- The quality indicators of the tobaccos of the introduced varieties do not appear unidirectional in the different growing districts.
- The quality assessment of the introduced varieties should be made differentially for each district separately.
- There is no convincing difference in the investigated quality indicators between the newly introduced varieties and the
check ones. Some trend towards better quality of the introduced varieties is established.

- By complex valuation of the quality indicators the summary of the results for the separate districts is, as follows:
  - District of Pazardzhik /Kap. Dimitrievo/. PVH19 variety is better;
  - District of Parvomay /Debar/. The experimental sample K394 is the best;
  - District of arvomay /Dalbok Izvor/. The experimental sample K394 is better;
- The summary of the results demonstrates that it is reasonable to extend the area of application of the introduced varieties K394 and PVH19, whereas it cannot be expected any deterioration of the variety composition, but rather the reverse – the same is more likeable to become better.

REFERENCES