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NEKE KARAKTERISTIKE AMERIČKE LINIJE FLUE-CURED DUHANA NC 744

SOME CHARACTERISTICS OF AMERICAN FLUE-CURED TOBACCO LINE NC 744

Blazica Šmalcelj

UVOD


MATERIJAL I METODE


U 1985. prilikom klasiranja uočena je veća količina duhana izrazito crvene boje, koja je u literaturi opisana kao "trešnijino crvenilo" (cherry red) i smatra se pokazateljem prisutnosti normikotina. Takav duhan, karakteristične crvene boje, precrven da bi se upotrebio u industriji cigaretara, svrstavan je u niže klase (Wada, 1957), pa niti u našim istraživanjima nije ocijenjen više od četvrte klase. Te i narednih godina zabilježene su berbe s većom količinom crvenog duhana. Ovisno o broju berbi i broju ponavljanja, broj takvih berbi mogao je biti 0-20, 0-24, i bit će primijenjen kao preliminarna procjena prisutnosti normikotina. Na jednak način procijenjena je prisutnost izrazito zelenih listova.
B. Šmalcelj: Neke karakteristike američke linije flue-cured duhana NC 744

u osušnom duhanu.

Za procjenu otpornosti prema Y virusu krumpira (PVY) iskorištena je prirodna infekcija u polju, kao i pri procjeni otpornosti Virginia D (Šmalcelj, 1990.).


Mjeren je prinos, procijenjena kvaliteta, otpornost prema PVY i prisutnost crvenih, odnosno izrazito zelenih listova u osušnom duhanu. Za potomstvo biljaka NC 744/25 do NC 744/30 izmjeren je visina biljke u zadnjem listu, broj listova, broj dana do početka cvatnje, te određen kemijski sastav. Visina biljke i broj listova mjerni su na 10 biljaka, u početku cvatnje, tj. kada je na 50% biljaka otvoren barem jedan cvijet. Uzorci za određivanje kemijskog sastava uzimani su kako je opisano, a jedno su određene i anorganske komponente, dok su organske komponente određene metodom refleksije u bliskom infracrvenom području.

Za sva mjerna svojstva, u svakom pokusu, testirane su razlike u odnosu na standard, a posebno razlike među potomstvom pojedinačnih biljaka NC 744 populacije.


REZULTATI I DISKUSIJA


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Prinos NC744 linije (kg/ha) u periodu 1984-1987.
*Table 1*
NC 744 line yield (kg/ha) in the period 1984-1987.

<table>
<thead>
<tr>
<th>Genotip genotype</th>
<th>GODINA YEAR</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Podravina</td>
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<td>3120</td>
<td>3050</td>
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<td>3590</td>
<td>4170</td>
<td>4070</td>
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Tablica 2
*Table 2*
NC 744 quality (% first class value) in the period 1984-1987.

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<th></th>
<th></th>
<th></th>
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<td>32</td>
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<td>F</td>
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<td>**</td>
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<td>NS</td>
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Tablica 3
*Table 3*

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<th>godina year</th>
<th>prinos yield</th>
<th>kvaliteta quality</th>
<th>nikotin nicoitine</th>
<th>bijelene vine proteins</th>
<th>šečeri sugars</th>
<th>CaO</th>
<th>K2O</th>
<th>K2O : CaO</th>
<th>MgO</th>
<th>Pepeo ash</th>
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<td>NS</td>
<td>NS</td>
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<td>NS</td>
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<tr>
<td>1985</td>
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**Tablica 4**  
*Table 4*  
*Karaktaristike NC 744 u periodu 1984-1987.*  
*Characteristics of NC 744 in the 1984-1987 period*

<table>
<thead>
<tr>
<th>genotip</th>
<th>prinos yield kg/ha</th>
<th>kvaliteta % vrijednosti I klase</th>
<th>nikotin %</th>
<th>bijelčevine protina %</th>
<th>šečeri sugars %</th>
<th>CaO %</th>
<th>K2O %</th>
<th>MgO %</th>
<th>pepeo ash %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podrava</td>
<td>3200</td>
<td>31</td>
<td>2.91</td>
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<td>19.98</td>
<td>3.80</td>
<td>3.96</td>
<td>1.08</td>
<td>0.42</td>
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<td>35</td>
<td>2.39</td>
<td>5.59</td>
<td>24.52</td>
<td>3.59</td>
<td>4.08</td>
<td>1.14</td>
<td>0.38</td>
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<tr>
<td>F</td>
<td>NS</td>
<td>NS</td>
<td>*</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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</tbody>
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**Tablica 5**  
*Table 5*  
*Karakteristika uroda po godinama*  
*Characteristic of yield each year*

<table>
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<tr>
<th>genotip</th>
<th>prinos yield kg/ha</th>
<th>kvaliteta % vrijednosti I klase</th>
<th>nikotin %</th>
<th>bijelčevine protina %</th>
<th>šečeri sugars %</th>
<th>CaO %</th>
<th>K2O %</th>
<th>MgO %</th>
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<tr>
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<td>2900</td>
<td>39</td>
<td>1.54</td>
<td>4.92</td>
<td>25.80</td>
<td>3.54</td>
<td>4.93</td>
<td>1.39</td>
<td>0.34</td>
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<tr>
<td>1985</td>
<td>3300</td>
<td>28</td>
<td>3.06</td>
<td>6.11</td>
<td>18.51</td>
<td>3.56</td>
<td>4.38</td>
<td>1.24</td>
<td>0.52</td>
</tr>
<tr>
<td>1986</td>
<td>3600</td>
<td>30</td>
<td>3.57</td>
<td>6.07</td>
<td>15.97</td>
<td>3.66</td>
<td>3.43</td>
<td>0.95</td>
<td>0.44</td>
</tr>
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<td>35</td>
<td>2.43</td>
<td>5.37</td>
<td>28.72</td>
<td>4.03</td>
<td>3.43</td>
<td>0.85</td>
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<td>NS</td>
<td>*</td>
<td>**</td>
<td>NS</td>
<td>*</td>
<td>*</td>
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<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>-</td>
<td>NS</td>
</tr>
</tbody>
</table>

**interakcija godine i geno-tipa / geno-type x year**
Listovi izrazito crvene boje, uočeni 1985. i narednih godina nisu ocjenjivani više od četvrte klase. Prema tablici 6 više takvih listova bilo je u duhanu linije NC 744, nego u duhanu standardne sorte Podravina, što je prouzročilo nižu ocjenu kvalitete duhana linije NC 744. Otpornost prema PVY, uočena u uvjetima prirodne infekcije u polju (tablica 7), potakla je medutim, interes za liniju NC 744, kao komercijalni genotip, no da bi se mogla koristiti kao komercijalni genotip potrebno je ukloniti „trešnjino crvenilo.“

**Tablica 6**

<table>
<thead>
<tr>
<th>genotip genotype</th>
<th>1985 t.c.</th>
<th>(0-20) z</th>
<th>1986 t.c.</th>
<th>(0-18) z</th>
<th>1987 t.c.</th>
<th>(0-24) z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podravina</td>
<td>0</td>
<td></td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>NC 744</td>
<td>9</td>
<td></td>
<td>11</td>
<td>5</td>
<td>14</td>
<td>5</td>
</tr>
</tbody>
</table>

**Tablica 7**

<table>
<thead>
<tr>
<th>genotip genotype</th>
<th>1986. (0-60)</th>
<th>1987. (0-80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podravina</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>NC 744</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

B. Šmalcelj: Neke karakteristike američke linije flue-cured duhana NC 744

U prvom pokusu testirano je potomstvo 12 biljaka (tablica 8). Statistički pouzdanih razlika u prinosu nije bilo, ni u odnosu na standarde, niti među potomstvom biljaka NC 744 populacije. Isto tako nije bilo statistički pouzdane razlike u kvaliteti. Broj biljaka sa simptomima PVY bio je 0 ili 1, kao i kod standarda. Ocjena trešnjinog crvenila, bila je između 1 i 12, dok je za sortu Drava bila 10. Ocjena zelenog lista u osušenom duhanu je za testirane genotipove između 3 i 12, dok je za sortu Podravina 13. Kako se za listove koji su nakon sušenja zadržali zelenu boju može pretpostaviti da u vrijeme berbe nisu bili tehnološki zreli, te da bi ubrani u fazi tehnološke zrelosti također mogli imati specifičnu crvenu boju (Wernsman i Matzinger, 1968), odabrano je potomstvo NC 744/12 biljke, za koje je zbroj ocjene za trešnjinu crvenilo, i ocjene za zeleni duhan najniži.

Tablica 8  Karakteristike potomstva NC 744/1 do NC 744/12 iz populacije NC 744

<table>
<thead>
<tr>
<th>genotip</th>
<th>prinos yield (kg/ha)</th>
<th>kvaliteta % vrijednosti 1 klase</th>
<th>biljaka sa simptomima PVY (0-60)</th>
<th>izrazito crvenih berbi (0-21)</th>
<th>izrazito zelenih berbi (0-21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podravina</td>
<td>3700</td>
<td>23</td>
<td>1</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Drava</td>
<td>3400</td>
<td>31</td>
<td>0</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>NC 744/1</td>
<td>3600</td>
<td>31</td>
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<td>12</td>
<td>3</td>
</tr>
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<td>NC 744/2</td>
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<td>1</td>
<td>6</td>
<td>9</td>
</tr>
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<td>7</td>
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<td>8</td>
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<td>5</td>
<td>12</td>
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</table>

**F-test između NC 744 genotipova / F-test between NC 744 genotypes

<table>
<thead>
<tr>
<th>genotip genotype</th>
<th>prinosi yield kg/ha</th>
<th>kvaliteta % vrijednosti I klase quality % 1st class value</th>
<th>biljka sa simptomima PVY planta with PVY symptoms 0-80</th>
<th>izrazito crvenih berbi cherry red harvest 0-28</th>
<th>izrazito zelenih berbi extremely greenish harvests 0-28</th>
</tr>
</thead>
<tbody>
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<td>Podravina</td>
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<td>0</td>
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<td>6</td>
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<tr>
<td>Drava</td>
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<td>11</td>
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<td>8</td>
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<td>LSD 1 %</td>
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** F-test između NC 744 genotipova / F-test between NC 744 genotypes
U trećem pokusu testirano je potomstvo 6 biljaka iz populacije NC 744 (tablica 10). Svi genotipovi iz NC 744 populacije evalju su 7 dana kasnije od standardnih sorti. Bili su oko 20 cm niži od Drave i oko 30 cm niži od Podravine, a imali su 1 do 2 lista više. Oni su imali također veći prinos, a većina od njih i bolju kvalitetu, no razlike nisu bile statistički pouzdane. Broj biljaka sa simptomima PVY bio je 0 do 9 u populacijama testiranih genotipova, odnosno 2 i 7 u populacijama standardnih sorti Drava i Podravina. Ocjene trešnjinog crvenila, i zelenog duhana su također vrlo visoke. Uspoređi li se broj dana do cvatnje s količinom zelenih listova u osušenom duhanu, vidljivo je da sorta Podravina, koja je cvala sedam dana prije genotipa NC 744/29, ima jednaku količinu zelenog lista u osušenom duhanu.

U prva dva pokusa nije zabilježeno vrijeme do početka cvatnje. Ako se međutim, pretpostavi da su razlike između standardnih sorti i NC 744 populacije bile slične razlici ustanovljenoj u trećem pokusu, zamjetljivo je da ocjene za zeleni duhan također nisu raspoređene prema broju dana do cvatnje.


Tablica 10  Karakteristike potomstva NC 744/25 do NC 744/30 iz populacije NC 744, I

Table 10  Characteristic of NC 744/25 to NC 744/30 progeny from the NC 144 population I

| genotip geno- | broj dana do cvatnje | visina bijelje do zadnjeg lista | broj listova | prinos yield | kvaliteta % vrijednosti I klase quality | kvaliteta % 1st class value | biljaka sa simptomima PYY plants with PYY symptoms | izrazito crven. berbi extreme red harvests | izrazito zelenih berbi extremely greenish harvests |
| type | days to flower | height to top leaf cm | number of leaves | kg/ha | 0-80 | 0-28 | 0-28 |
| Podravina | 64 | 158 | 18.2 | 3400 | 38 | 7 | 9 | 7 |
| Drava | 64 | 146 | 19.0 | 3900 | 37 | 2 | 18 | 4 |
| NC 744/25 | 71 | 122 | 19.1 | 4300 | 41 | 1 | 8 | 10 |
| NC 744/26 | 71 | 123 | 19.4 | 4300 | 41 | 0 | 15 | 10 |
| NC 744/27 | 71 | 126 | 19.5 | 4000 | 34 | 2 | 20 | 10 |
| NC 744/28 | 71 | 122 | 19.7 | 4700 | 41 | 0 | 17 | 10 |
| NC 744/29 | 71 | 128 | 20.1 | 4400 | 39 | 9 | 13 | 4 |
| NC 744/30 | 71 | 129 | 20.3 | 4400 | 40 | 0 | 11 | 9 |
| GD 5% | 0 | 11 | 0.9 | NS | NS | - | - | - |
| LSD 1% | 0 | 15 | 1.3 | NS | NS | - | - | - |
| ** | NS | NS | NS | NS | NS | - | - | - |

** F-test izmedu NC 744 genoti-pova / F-test between NC 744 genotypes **
Tablica 11  
Karaktaristike potomstva NC 744/25 do NC 744/30 iz populacije NC 744, II  

*Table 11*  
*Characteristics of NC 744/25 to NC 744/30 from the NC 744 population, II*

<table>
<thead>
<tr>
<th>genotip genotype</th>
<th>nikotin nicotine %</th>
<th>bijelčevine proteins %</th>
<th>šečeri sugars %</th>
<th>CaO %</th>
<th>K2O %</th>
<th>K2O : CaO</th>
<th>MgO %</th>
<th>pepo ash %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podravina</td>
<td>3.03</td>
<td>5.39</td>
<td>16.00</td>
<td>4.18</td>
<td>3.12</td>
<td>0.78</td>
<td>0.36</td>
<td>15.09</td>
</tr>
<tr>
<td>Drava</td>
<td>2.78</td>
<td>4.74</td>
<td>17.99</td>
<td>3.80</td>
<td>3.64</td>
<td>0.96</td>
<td>0.35</td>
<td>15.73</td>
</tr>
<tr>
<td>NC 744/25</td>
<td>2.52</td>
<td>4.42</td>
<td>24.38</td>
<td>3.84</td>
<td>3.34</td>
<td>0.89</td>
<td>0.27</td>
<td>14.09</td>
</tr>
<tr>
<td>NC 744/26</td>
<td>2.47</td>
<td>4.53</td>
<td>22.64</td>
<td>3.63</td>
<td>3.47</td>
<td>0.96</td>
<td>0.26</td>
<td>14.40</td>
</tr>
<tr>
<td>NC 744/27</td>
<td>2.44</td>
<td>4.97</td>
<td>21.21</td>
<td>3.97</td>
<td>3.64</td>
<td>0.94</td>
<td>0.30</td>
<td>15.22</td>
</tr>
<tr>
<td>NC 744/28</td>
<td>2.11</td>
<td>4.22</td>
<td>28.42</td>
<td>3.14</td>
<td>3.60</td>
<td>1.97</td>
<td>0.19</td>
<td>13.45</td>
</tr>
<tr>
<td>NC 744/29</td>
<td>2.34</td>
<td>4.39</td>
<td>26.71</td>
<td>3.29</td>
<td>3.38</td>
<td>1.02</td>
<td>0.27</td>
<td>13.00</td>
</tr>
<tr>
<td>NC 744/30</td>
<td>2.36</td>
<td>4.31</td>
<td>26.34</td>
<td>3.24</td>
<td>3.35</td>
<td>1.05</td>
<td>0.22</td>
<td>13.28</td>
</tr>
<tr>
<td>GD 5 %</td>
<td>0.29</td>
<td>NS</td>
<td>5.77</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>0.07</td>
<td>1.70</td>
</tr>
<tr>
<td>LSD 1 %</td>
<td>0.39</td>
<td>NS</td>
<td>7.87</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>0.09</td>
<td>2.31</td>
</tr>
<tr>
<td>**</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

** F-test između NC 744 genoti-pova / *F-test between NC 744 genoty-pes*
Tablica 12  

Karakteristike NC 744/12 u 1989.

*Table 12*  

*Characteristics of NC 744/12 in 1989.*

<table>
<thead>
<tr>
<th>karakteristika characteristics</th>
<th>genotip genotype</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>prinos / yield</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(kg/ha)</td>
<td></td>
</tr>
<tr>
<td>kvaliteta / quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% vrijednosti I klase</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% 1st class value</td>
<td></td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>40</td>
</tr>
<tr>
<td>broj biljaka s PVY simptomima / plants with PVY symptoms</td>
<td>0-80</td>
<td>5</td>
</tr>
<tr>
<td>izrazito crvenih berbi / „cherry red“ harvests</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>izrazito zelenih berbi / extremely greenish harvests</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>nikotin / nicotine</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.99</td>
<td>2.09</td>
</tr>
<tr>
<td>bjelančevina / proteins</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.51</td>
<td>5.14</td>
</tr>
<tr>
<td>šečeri / sugars</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.42</td>
<td>27.13</td>
</tr>
<tr>
<td>CaO</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.04</td>
<td>4.01</td>
</tr>
<tr>
<td>K2O</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.41</td>
<td>3.10</td>
</tr>
<tr>
<td>K2O:CaO</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.68</td>
<td>0.78</td>
</tr>
<tr>
<td>MgO</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.41</td>
<td>0.26</td>
</tr>
<tr>
<td>pepeo / ash</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.03</td>
<td>12.95</td>
</tr>
</tbody>
</table>

**ZAKLJUČAK**

1. NC 744 linija ima prinos i kvalitetu u nivou standardne sorte Podravina, ali ima znatno manje nikotina i više šečera.

2. Razlika u ocjeni otpornosti prema PVY (0-9) i razlika u ocjeni „trešnjinog crvenila, (1-20) među потомством 30 biljaka iz NC 744 populacije opravđava postupak reselekcije NC 744 populacije, kojim se želi izdvojiti genotip bez „trešnjinog crvenila, a zadovoljavajuće otpornosti na PVY.
3. Potomstvo odabrane biljke NC 744/12 ima veći prinos od sorte Drava, manje biljaka sa simptomima PVY, nižu ocjenu za „trešnjino crvenilo„, manje nikotina, više šćera, te manje magnezija i pepela.

NEKE KARAKTERISTIKE AMERIČKE LINIJE FLUE-CURED DUHANA NC 744

SAŽETAK

NC 744 je američka flue-cured linija, otporna na Y virus krumpira (PVY), koja zbog neugodnog okusa pri pušenju nije registrirana kao sorta.

U sortnim pokusima na pokušalištu Duhanskog instituta Zagreb, u Pitomači, u periodu od 1984. do 1987. prinos i kvaliteta ove linije nisu bili bolji od prinosa i kvalitete standardne sorte Podravina, no sadržaj nikotina bio je značajno niži, a sadržaj šćera značajno viši. Izkazana otpornost prema PVY pobudila je interes za ovu liniju kao komercijalni genotip. Zamjete količine listova karakteristične crvene boje u osušenom duhanu, veće nego kod „Podravine„, u literaturi opisane kao „cherry red„, su međutim, neprihvatljive kod komercijalnih genotipova. Prema modelima nasljeđivanja nor-nikotina, koji se smatra uzročnikom „cherry red„, pretpostavljen je da u populaciji NC 744 postoje genotipovi koji ne konvertiraju nikotin u nor-nikotin, a imaju zadovoljavajuću otpornost prema PVY.

NC 744/12 je jedan od 30 testiranih genotipova iz NC 744 populacije. U usporedbi sa sortom Drava imao je manje biljaka sa simptomima PVY, četiri puta nižu ocjenu za „cherry red„, veći prinos, manje nikotina i pepela i više šćera. Postupak izbora i testiranja će biti nastavljen.

SOME CHARACTERISTICS OF THE AMERICAN FLUE-CURED TOBACCO LINE NC 744

SUMMARY

NC 744 is an American flue-cured line, resistant to potato virus Y (PVY). It was not registered as a variety because of its unacceptable taste in smoking.

In variety tests at the Tobacco Institute Zagreb, the experimental field in Pitomača, in the period 1984-1987, the yield and quality of this line were not significantly better than the yield and quality of „Podravina„, but it had more sugars and less nicotine.

The resistance to PVY shown by this line, has made it interesting for commercial use. However, a large number of „cherry red„, leaves, much larger than in „Podravina„, makes it unacceptable as a commercial genotype.

According to the mode of inheritance of nor-nicotine, which causes cherry redness, in the NC 744 population there could be genotypes which are incapable of converting
nicotine to nornicotine and whose resistance to PVY is satisfactory. 
NC 744/12 is one of 30 tested genotypes from the NC 744 population. It has a lower number of plants with PVY symptoms, fewer cherry red leaves, higher yield, lower nicotine and ash, and more sugars, than ‘Drava’. 
The procedure will be continued.

LITERATURA


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