BIOMETRIČKA ANALIZA NEKIH POPULACIJA KUKURUZA

BIOMETRICAL ANALYSIS OF SOME MAIZE POPULATIONS

S. Milas, D. Parlov

U V O D

Izuzetne vrijednosti određenih svojstava kojima se odlikuje domaća sorta „Beljski zuban“, koriste se u oplemenjivačkim programima u Institutu za oplemenjivanje i proizvodnju bilja, Fakulteta poljoprivrednih znanosti još od 1965. godine.

Čvrsta stabljika,obilje polena, dobra otpornost na Helminthosporium turcicum, Ustilago maydis, rani porast, dugi klip, dobar kemijski sastav zrna, sve su to svojstva ove sorte koja su oplemenjivači kukuruza koristili, na stječeći ih „unositi“ u linije i hibride koje su kreirali. U toku procesa stvaranja linija, posebna je pažnja posvećivana izboru mnogih gospodarski poželjnih svojstava, te računjanju međusobnih korelativnih veza u svrhu direktnog ili indirektnog puta u oplemenjivanju poželjnog svojstva.

MATERIJALI I METODIKA

U ovom radu ćemo prikazati dio istraživanja koji se odnosi na proučavanje materijala kojeg čini 36 kombinacija križanja na bazi pet samooploidnih linija porijeklom iz sorte Beljski zuban, s testirima takoder tipa zuban.

Kompletan materijal je sijan dvije uzastopne godine u pokusne (PK1 i PK2) postavljene po latinskom pravokutniku u šest ponavljanja. Veličina parcele bila je 6,5 m², s razmakom od 0,7 m između redova i 0,45 m u redu i planiranim sklopom od 40 biljaka po parceli (ili 63492 biljke po ha).

Osim prinosa pratili smo i analizirali još tridesetak značajnih svojstava i to na bazi biljke ili na bazi osnovne parcele (ovisno o svojstvu). Čitavo vrijeme posebno smo nastojali provoditi analize tako da nam omoguće otkrivanje međusobnih veza svojstava.

Pratili smo slijedeća svojstva:
1. masa sirovog klipa
2. broj biljaka po parcelici
3. % zrna
4. vлага
5. broj dana do metličanja
6. broj dana do svilanja
7. visina biljke
8. visina do prvog klipa
9. broj listova
10. rani porast
11. broj jaličevih biljaka
12. broj snjetljivih biljaka
13. broj poleglih biljaka
14. broj polomljenih biljaka
15. duljina klipa
16. debljina klipa
<table>
<thead>
<tr>
<th>Broj</th>
<th>Opis</th>
<th>Broj</th>
<th>Opis</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>brod redova na klipu</td>
<td>25.</td>
<td>duljina zrna</td>
</tr>
<tr>
<td>18.</td>
<td>broj zrna u redu</td>
<td>26.</td>
<td>širina zrna</td>
</tr>
<tr>
<td>19.</td>
<td>broj zrna na klipu</td>
<td>27.</td>
<td>debljina zrna</td>
</tr>
<tr>
<td>20.</td>
<td>masa klipa</td>
<td>28.</td>
<td>promjer stabljike (1)</td>
</tr>
<tr>
<td>21.</td>
<td>masa zrna</td>
<td>29.</td>
<td>promjer stabljike (2)</td>
</tr>
<tr>
<td>22.</td>
<td>oklasak</td>
<td>30.</td>
<td>površina lista</td>
</tr>
<tr>
<td>23.</td>
<td>masa 1000 zrna</td>
<td>31.</td>
<td>prinos</td>
</tr>
<tr>
<td>24.</td>
<td>% oklaska</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Za svako svojstvo procijenili smo najvažnije deskriptivne parametre i to:
- prosječnu vrijednost (\(x\))
- varijacionu širinu (max-min)
- standardnu devijaciju (s)
- varijacioni koeficijent (cv)

Međusobnu povezanost svojstava analizirali smo pomoću korelacionih analiza koje su uključivale procjenu različitih korelacionih koeficijenata:
- jednostavnih
- multiplih
- parcijalnih
- path

Isto tako smo preko procjene kvantitativnih parametara za linije i kombinacije križanja, došli do kriterija za izbor linija - dobrih kombinatora za pojedina svojstva, odnosno izbor križanaca.

Naime, procijenili smo:
- efekte opće kombinatorne sposobnosti linija (OKS)
- efekte specifične kombinatorne sposobnosti (SKS)
- korelaciju između OKS i SKS (pomoću Spearman-ovog koeficijenta ranga \(r_s\))

**REZULTATI I DISKUSIJA**

Na osnovu prosječnih vrijednosti i varijacionih koeficijenata, očekivali smo da u istraživanim populacijama raspolažemo s genotipovima izuzetnih vrijednosti za neka svojstva (tabele 1 i 2).

Široki raspon i relativno velike vrijednosti varijacionog koeficijenta ukazuju na varijabilnost unutar populacije za pojedina svojstva, odnosno mogućnost pronalaženja poželjnih genotipova.

Tako se u oba pokusa ističu svojstva: masa klipa (1), svojstva čvrste stabljike (11,12,13,14), broj zrna u redu (19), odnosno prinos (31). Kako je već spomenuto, analizom korelacionih odnosa željeli smo otkriti način i stupanj povezanosti među svojstvima. Za to smo analizirali sve moguće korelacije među proučavanim svojstvima, (a to je 465 korelacija).
### Табела 1: Пресјечне вриједности и варијабилност истраживаних својстава (ПК1)

*Table 1: Mean values and variability of investigated characteristics (Exp 1)*

<table>
<thead>
<tr>
<th>Наслов својства</th>
<th>Рaspон (мин-макс)</th>
<th>Пројек (x)</th>
<th>Var. коef. (c.v.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Characteristic</strong></td>
<td><strong>Range (мин-макс)</strong></td>
<td><strong>Mean (x)</strong></td>
<td><strong>Coeff. of var. (c.v.)</strong></td>
</tr>
<tr>
<td>1.</td>
<td>6,74 - 12,90</td>
<td>9,44</td>
<td>13,02</td>
</tr>
<tr>
<td>2.</td>
<td>23,00 - 40,00</td>
<td>38,24</td>
<td>5,90</td>
</tr>
<tr>
<td>3.</td>
<td>74,66 - 83,28</td>
<td>78,97</td>
<td>3,04</td>
</tr>
<tr>
<td>4.</td>
<td>21,96 - 30,71</td>
<td>26,57</td>
<td>9,40</td>
</tr>
<tr>
<td>5.</td>
<td>60,00 - 71,00</td>
<td>64,79</td>
<td>3,50</td>
</tr>
<tr>
<td>6.</td>
<td>63,00 - 74,00</td>
<td>67,61</td>
<td>3,62</td>
</tr>
<tr>
<td>7.</td>
<td>174,00 - 271,00</td>
<td>238,44</td>
<td>5,80</td>
</tr>
<tr>
<td>8.</td>
<td>62,00 - 111,00</td>
<td>90,21</td>
<td>10,36</td>
</tr>
<tr>
<td>9.</td>
<td>12,00 - 15,00</td>
<td>13,66</td>
<td>4,80</td>
</tr>
<tr>
<td>10.</td>
<td>15,00 - 30,00</td>
<td>24,75</td>
<td>19,61</td>
</tr>
<tr>
<td>11.</td>
<td>0,00 - 4,0</td>
<td>0,52</td>
<td>157,46</td>
</tr>
<tr>
<td>12.</td>
<td>0,00 - 5,0</td>
<td>0,64</td>
<td>134,70</td>
</tr>
<tr>
<td>13.</td>
<td>0,00 - 26,00</td>
<td>5,13</td>
<td>77,07</td>
</tr>
<tr>
<td>14.</td>
<td>0,00 - 33,00</td>
<td>9,42</td>
<td>82,73</td>
</tr>
<tr>
<td>15.</td>
<td>15,00 - 22,00</td>
<td>19,18</td>
<td>6,78</td>
</tr>
<tr>
<td>16.</td>
<td>41,00 - 51,00</td>
<td>45,07</td>
<td>4,27</td>
</tr>
<tr>
<td>17.</td>
<td>12,00 - 22,00</td>
<td>16,50</td>
<td>11,67</td>
</tr>
<tr>
<td>18.</td>
<td>32,00 - 47,00</td>
<td>38,92</td>
<td>8,39</td>
</tr>
<tr>
<td>19.</td>
<td>470,00 - 868,00</td>
<td>634,40</td>
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</tr>
<tr>
<td>20.</td>
<td>1,36 - 2,52</td>
<td>1,93</td>
<td>12,08</td>
</tr>
<tr>
<td>21.</td>
<td>1,13 - 2,14</td>
<td>1,64</td>
<td>12,27</td>
</tr>
<tr>
<td>22.</td>
<td>0,18 - 0,41</td>
<td>0,29</td>
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<td>1,76 - 3,75</td>
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<td>24.</td>
<td>10,44 - 20,04</td>
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<td>4,06</td>
<td>5,87</td>
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<tr>
<td>28.</td>
<td>5,00 - 7,00</td>
<td>6,01</td>
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</tr>
<tr>
<td>29.</td>
<td>6,00 - 7,00</td>
<td>6,73</td>
<td>6,64</td>
</tr>
<tr>
<td>30.</td>
<td>426,00 - 738,00</td>
<td>595,03</td>
<td>10,96</td>
</tr>
<tr>
<td>31.</td>
<td>78,58 - 129,24</td>
<td>103,12</td>
<td>10,72</td>
</tr>
<tr>
<td>Svojstvo</td>
<td>Raspon (min-max)</td>
<td>Prosjek (x)</td>
<td>Var.koef.(c.v.)</td>
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<td>----------</td>
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<td>-----------------</td>
</tr>
<tr>
<td>Character</td>
<td>Range (min-max)</td>
<td>Mean (x)</td>
<td>Coeff.of var. (c.v.)</td>
</tr>
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<td>1.</td>
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<td>11,99</td>
</tr>
<tr>
<td>2.</td>
<td>28,00 - 40,00</td>
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<td>7,37</td>
</tr>
<tr>
<td>3.</td>
<td>74,72 - 83,83</td>
<td>78,90</td>
<td>2,77</td>
</tr>
<tr>
<td>4.</td>
<td>23,84 - 32,79</td>
<td>28,58</td>
<td>7,29</td>
</tr>
<tr>
<td>5.</td>
<td>53,00 - 60,00</td>
<td>56,78</td>
<td>3,16</td>
</tr>
<tr>
<td>6.</td>
<td>56,00 - 64,00</td>
<td>59,89</td>
<td>2,87</td>
</tr>
<tr>
<td>7.</td>
<td>232,00 - 295,00</td>
<td>260,48</td>
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<tr>
<td>8.</td>
<td>73,00 - 142,00</td>
<td>105,62</td>
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<td>9.</td>
<td>12,00 - 16,00</td>
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</tr>
<tr>
<td>10.</td>
<td>10,00 - 30,00</td>
<td>25,37</td>
<td>19,42</td>
</tr>
<tr>
<td>11.</td>
<td>0,00 - 6,00</td>
<td>0,96</td>
<td>124,61</td>
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<tr>
<td>12.</td>
<td>0,00 - 8,00</td>
<td>0,61</td>
<td>167,38</td>
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<tr>
<td>13.</td>
<td>0,00 - 22,00</td>
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<td>14.</td>
<td>0,00 - 29,00</td>
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<td>15,00 - 21,00</td>
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<td>16.</td>
<td>39,00 - 49,00</td>
<td>43,75</td>
<td>4,31</td>
</tr>
<tr>
<td>17.</td>
<td>12,00 - 20,00</td>
<td>16,52</td>
<td>11,06</td>
</tr>
<tr>
<td>18.</td>
<td>27,00 - 46,00</td>
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<td>9,39</td>
</tr>
<tr>
<td>19.</td>
<td>364,00 - 823,00</td>
<td>573,51</td>
<td>15,17</td>
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<tr>
<td>20.</td>
<td>1,13 - 2,03</td>
<td>1,56</td>
<td>10,78</td>
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<tr>
<td>21.</td>
<td>0,94 - 1,74</td>
<td>1,33</td>
<td>11,27</td>
</tr>
<tr>
<td>22.</td>
<td>0,15 - 0,30</td>
<td>0,24</td>
<td>14,52</td>
</tr>
<tr>
<td>23.</td>
<td>1,83 - 2,98</td>
<td>2,40</td>
<td>10,26</td>
</tr>
<tr>
<td>24.</td>
<td>10,27 - 20,40</td>
<td>15,23</td>
<td>12,14</td>
</tr>
<tr>
<td>25.</td>
<td>10,00 - 12,00</td>
<td>11,25</td>
<td>5,23</td>
</tr>
<tr>
<td>26.</td>
<td>7,00 - 9,00</td>
<td>7,72</td>
<td>7,27</td>
</tr>
<tr>
<td>27.</td>
<td>4,00 - 5,00</td>
<td>4,10</td>
<td>7,89</td>
</tr>
<tr>
<td>28.</td>
<td>5,00 - 7,00</td>
<td>5,97</td>
<td>4,68</td>
</tr>
<tr>
<td>29.</td>
<td>6,00 - 8,00</td>
<td>7,00</td>
<td>6,96</td>
</tr>
<tr>
<td>30.</td>
<td>372,00 - 677,00</td>
<td>513,92</td>
<td>13,14</td>
</tr>
<tr>
<td>31.</td>
<td>65,23 - 117,95</td>
<td>90,15</td>
<td>10,36</td>
</tr>
</tbody>
</table>
Na tabeli 3 najprije prikazujemo jednostavne korelacije koeficijente, parcijalne korelacije koeficijente i regresione koeficijente između prinosa i svih ostalih svojstava.

Među svim ostalim analiziranim korelacijama izabrali smo samo one koje su rezultirale signifikantnim korelacijama i to većim od 0.4, a prikazujemo ih na tabeli 4.

Može se uočiti da je duljina klipa (15) u pozitivnoj korelaciji s:
brojem zrna u redu (18), masom zrna u redu (20) i masom zrna (21). Broj zrna na klipu (19) je pozitivno koreliran s debljinom klipa, (16), brojem redova na klipu (17), brojem zrna u redu (18), masom zrna na klipu (20) i površinom lista (30).

Međutim, ustanovljena je negativna korelativna povezanost broja zrna na klipu (19) s masom 1000 zrna (23) i širinom zrna (26) Duljina zrna (25) je u pozitivnoj korelaciji s masom zrna (21) i prinose (31), a u negativnoj s % oklaska (24).

Kako korelacioni koeficijenti jednostavno mjeri međusobnu povezanost svojstava, bez obzira na uzročnost, pristupili smo i analiziranju povezanosti među svojstvima pomoću path korekcijenata. Path analiza naime, specifičira uzročno-posljedični odnos i mjeri relativnu važnost pojedinih varijabli u odnosu na zavisnu varijablu. Na tabeli 5 prikazani su neki od rezultata path analize. To znači korelacioni (r_{xy}) i path (P_{xy}) koeficijenti.

Uočili smo da su u vrlo malom broju korelacija direktni utjecaji veliki, kao recimo kod mase klipa (1) i % zrna na klipu (3). Gotovo u svim korelacijama očito su mnogo važniji, indirektni efekti. Zato smo svaki korelacioni koeficijent raščlanili na direktnе и indirektnе efekte.

Način na koji smo svaki korelacioni koeficijent raščlanjivali na direktnе и indirektnе utjecaje prikazujemo na tabeli 6.

Tako je svaku korelativnu vezu bilo moguće dalje analizirati s gledišta načina međusobnih utjecaja, a u smislu uzročno-posljedične veze.

Ovakva analiza naime omogućava otkrivanje i onih indirektnih utjecaja koji postoje među varijablama, a koje jednostavnim korelacijama nije moguće procijeniti. Ti efekti su, promatranji u vidu svojih numeričkih vrijednosti, primjenjivlji isključivo za specifični materijal na koji se odnose. Nikako se ne mogu generalizirati.

<table>
<thead>
<tr>
<th>Tabela 3</th>
<th>Korelacioni i regresioni koeficijenti između prinosa (svojstvo 31) i drugih svojstava</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 3</strong></td>
<td><em>Correlation and regression coefficients among yields (variable 31) and other characters</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PK1 (Exp 1)</th>
<th>PK2 (Exp2)</th>
<th>PK1 (Exp 1)</th>
<th>PK2 (Exp2)</th>
<th>PK1 (Exp1)</th>
<th>PK2 (Exp2)</th>
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<td>0,99</td>
<td>10,89</td>
<td>10,67</td>
</tr>
<tr>
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<td>-0,09</td>
<td>-0,98</td>
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<table>
<thead>
<tr>
<th></th>
<th>Korelacioni koef. (c.r.)</th>
<th>Parcijalni korel. koef.</th>
<th>Regresioni koeficijent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correlation coeff. (c.r.)</td>
<td>Partial correl. coeff.</td>
<td>Regression coefficients</td>
</tr>
<tr>
<td>PK1 (Exp 1)</td>
<td>PK2 (Exp 2)</td>
<td>PK1 (Exp 1)</td>
<td>PK2 (Exp 2)</td>
</tr>
<tr>
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<td>0,28</td>
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<tr>
<td>7.</td>
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<td>-0,07</td>
</tr>
<tr>
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<td>0,00</td>
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<tr>
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<td>0,10</td>
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<td>-0,07</td>
</tr>
<tr>
<td>12.</td>
<td>0,13</td>
<td>0,03</td>
<td>0,17</td>
</tr>
<tr>
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<td>-0,24</td>
<td>-0,30</td>
<td>0,10</td>
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31. = dependent variable
|   | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 4 | 0.53 | 0.70 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 5 | -0.50 | 0.46 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 6 | -0.44 | 0.50 |    |    |    | 0.81 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 0.91 |    |
| 16 | 0.45 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 18 |    | 0.44 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 19 |    |    | 0.54 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 20 | 0.50 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 21 | 0.62 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 22 | 0.47 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 23 | 0.61 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 24 | -0.67 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 25 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 26 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 30 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 31 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

Korelacioni koeficijenti medu nekim svojstvima

Correlation coefficients among some characters
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<th>Exp 2</th>
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<td>$r_{x_iy}$</td>
<td>$P_{x_iy}$</td>
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$31 = y$
Tabela 6. Prikaz raščlanjivanja korelacionih koeficijenata na direktno i indirektno efekte
Table 6  Separation of correlation coefficients into direct and indirect effects

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<thead>
<tr>
<th>Korelacioni koeficijenti</th>
<th>Direktni efekti svake varijable na 31</th>
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<td>Corelacion coefficients</td>
<td>Direct effect of each variable on 31</td>
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<td>$P_{1/31}$</td>
</tr>
<tr>
<td>$r_{3/31}$  $r_{3/4}$  $r_{3/20}$  $r_{3/21}$</td>
<td>$P_{3/31}$</td>
</tr>
<tr>
<td>$r_{4/31}$  $r_{4/20}$  $r_{4/21}$</td>
<td>$P_{4/31}$</td>
</tr>
<tr>
<td>$r_{20/31}$  $r_{20/21}$</td>
<td>$P_{20/31}$</td>
</tr>
<tr>
<td>$r_{21/31}$</td>
<td>$P_{21/31}$</td>
</tr>
</tbody>
</table>

$r_{1/31} = P_{1/31} + r_{1/3}P_{3/31} + r_{1/4}P_{4/31} + r_{1/20}P_{20/31} + r_{1/21}P_{21/31}$
$r_{3/31} = P_{3/31} + r_{3/1}P_{1/31} + r_{3/4}P_{4/31} + r_{3/20}P_{20/31} + r_{3/21}P_{21/31}$
$r_{4/31} = P_{4/31} + r_{4/1}P_{1/31} + r_{4/3}P_{3/31} + r_{4/20}P_{20/31} + r_{4/21}P_{21/31}$
$r_{20/31} = P_{20/31} + r_{20/1}P_{1/31} + r_{20/3}P_{3/31} + r_{20/4}P_{4/31} + r_{20/21}P_{21/31}$
$r_{21/31} = P_{21/31} + r_{21/1}P_{1/31} + r_{21/3}P_{3/31} + r_{21/4}P_{4/31} + r_{21/20}P_{20/31}$

Medjutim, informacija o njihovim veličinama i odnosima, bez sumnje je neobično korisna u procesu oplemenjivanja.

Osim ovih odnosa proučavali smo i kombinatorne sposobnosti linija (i testera) na temelju kojih su kreirane ove populacije. Vrijednosti efekata općih kombinatornih sposobnosti linija za neka gospodarski važna svojstva prikazana su na tabeli 7.

Procjene efekata dosta su se razlikovale u ova dva pokusa. Možda je dio objašnjenja u dvije vrlo različite godine: prva je bila vrlo vlažna i općenito za kukuruz nepovoljnija od druge godine.

Ipak, u oba pokusa linija Bc 14 se ističe najvećim vrijednostima efekata opće kombinatorne sposobnosti za prinos, rani porast, broj listova, indeks lišne površine, debljini klipa i broj zrna u redu. Linija Bc 7A imala je najveći efekt OKS za postotak zrna i masu 1000 zrna.

Najtopornije na lom i polijeganje bile su linije Bc 7A i Bc 13. Kod linije Bc 13 utvrđene su i najveće vrijednosti efekata OKS za duljinu klipa, te visinu biljke i visinu do klipa.

Isto tako se linije Bc 13 i Bc 14 ističu kao najranije linije.

Na osnovu analize specifičnih kombinatornih i procijenjenih efekata SKS za sva ispitivana svojstva, mogli smo izdvojiti križance koji najviše obeckavaju. Na tabeli 8 prikazane su vrijednosti efekata SKS za prinos, gdje se u oba pokusa ističu križanja Bc 14 x A 375 i Bc 14 x OH 43.
Table 7: General combining ability effects of lines for some agricultural characters

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<th>Be 7A</th>
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<th>PK 2</th>
<th>Be 15</th>
<th>PK 1</th>
<th>PK 2</th>
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<th>PK 1</th>
<th>PK 2</th>
<th>Be 9</th>
<th>PK 1</th>
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<th>Be 14</th>
<th>PK 1</th>
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<td>PK 2</td>
<td>PK 1</td>
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ZAKLJUČAK

Na temelju provedenih istraživanja i analiza, došli smo do slijedećih zaključaka:

- preko procijenjenih parametara prošjeka i varijabilnosti svojstava, bilo je moguće izdvojiti genotipove visokih vrijednosti za masu klipa, čvrstoču stabiljike, broj zrna u redu i prinos.

- Analizom korelacije među svojstvima utvrđene su pozitivne korelacije između: duljine klipa i broja zrna i redu, odnosno mase zrna, između broja zrna na klipu i debljine klipa, broja redova na klipu, broja zrna u redu, mase zrna na klipu i površine lista. Negativna korelacija je ustanovljena između broja zrna na klipu i mase 1000 zrna, odnosno širine zrna.

- Pomoću path koeficijenata, utvrđeno je da su direktni utjecaji pojedinih svojstava na prirod relativno mali, odnosno da ima značajnih indirektnih efekata pojedinih svojstava na prinos. Tako je vrlo jak indirektn utjecaj duljine klipa preko broja zrna na masu zrna, kao i i indirektn utjecaj mase 1000 zrna preko broja zrna na masu zrna.

- Iz procjene efekata opće i specifične kombinatorne sposobnosti, utvrdili smo da se linije Bc 14 ističe visokim vrijednostima efekata OKS za prinos, rani porast, broj listova, indeks lisne površine, debljina klipa i broj zrna u redu, linija Bc 7A za postotak zrna i masu 1000 zrna, kao i otpornost na lom i polijeganje (uz liniju Bc 13).

Kod linije Bc 13 utvrđene su najveće vrijednosti efekata OKS za duljinu klipa, te visinu biljke i visinu do klipa.

Pomoću efekata SKS izdvojili smo križance koji obećavaju najveće prinose: Bc 14 x A 375 i Bc 14 x OH 43.

SAŽETAK

Proučavane su populacije kukuruza dobivene na osnovu pet samooolodnih linija porijeklom iz domaće sorte Beljski zuban, a izvršene su analize prinosa, komponenata prinosa, svojstava kvalitete stabljike i dr. (ukupno 31 svojstvo).

Za svako svojstvo procijenjeni su najvažniji deskriptivni parametri: prosječna vrijednost, varijanca, raspon, te varijacioni koeficijent.

Isto tako su analizirane sve moguće korelativne veze među svojstvima, uključujući primjenu: jednostavnih, parcijalnih, multiplih korelacija, te path koeficijenata, sa svrhom da se otkrije direktna odnosno indirektna povezanost među svojstvima, koja se onda može dalje primijeniti u oplemenjivačkom procesu. Izvršena je i kvantitativna analiza u smislu testiranja opravdanosti općih i specifičnih kombinatornih sposobnosti i procjena efekata. Na osnovu svih procijenjenih parametara i pokazatelja, mogu se odabrati načini upotrebe korelacionih veza među svojstvima (direktnim ili indirektnim putem), izabrati linije koje dobro kombiniraju svako pojedino svojstvo, a isto tako i otkriti vrlo povoljna križanja (putem efekta specifične kombinatorne sposobnosti).

Riječ natuknice: kukuruz, path koeficijenti, opća i specifična kombinatorne sposobnosti.
SUMMARY

Maize populations, created on the basis of five inbred lines originating from the local variety Beljski zuban, were investigated. Analyses of yield and its components, quality characteristics of the stem, and others (31 characters in all) were made.

The most important descriptive parameters for each variable were estimated: mean value, range, variance, variation coefficient. All correlations possible among characters were also analysed. For this purpose we applied simple, partial and multiple correlation coefficients, as well as path coefficients, in order to find out if a direct or indirect dependance between variables exists, and if it does, to utilize it in the breeding process.

Quantitative analyses were also made, the significance of general and specific combining abilities was tested, and effects were calculated.

On the basis of parameters we obtained, different ways of utilization of, the investigated material can be chosen.

Significant effects of general and specific combining ability indicated good combinations for each investigated character.

Additional index words: maize, correlations, path coefficients, general and specific combining ability.

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