Correlation Analysis Among Oil Yield and Component Traits in Groundnut (Arachis hypogaea L.)

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The correlation coefficients among ten yield and yield attributing characters towards oil yield were investigated in F₃ generation for three crosses of groundnut during Jan – Apr. 2013. Oil yield had significant and positive correlation with number of pods per plant, 100-kernels weight, shell weight, shelling percentage and pod yield per plant in all the crosses viz., ICGV 00440 x ICGV 03128, ICGV 07359 x ICGV 05100 and ICGV 05100 x Sunoleic95R. All these traits had positive correlation among themselves. In case of cross ICGV 07359 x ICGV 05100 alone, oil yield had positive and significant correlation with kernel yield per plant and oil content. The trait number of branches had significant and negative correlation with oil yield in all the crosses. Hence, number of branches per plant, number of pods per plant, 100-kernels weight, shell weight, shelling percentage and pod yield per plant may be considered as selection indices for oil yield per plant.

Key words: Groundnut, Oil yield, Selection indices.

Groundnut, Arachis hypogaea L., is an important crop for oil production in tropical and subtropical areas. It provides a rich source of high-quality, edible oil (45–55%) and easily digestible protein (23–25%). Over 60% of global groundnut production is crushed for extraction of oil for edible and industrial uses, while 40% is consumed in food uses and seed purpose. Groundnut oil is an excellent cooking medium because of its high smoking point. India, China, Myanmar, and Vietnam use groundnut oil for cooking purpose extensively. Increasing of oil yield is one of the most important goal in groundnut breeding programme. Direct selection for oil content is not easy, as it involves lengthy laboratory test (soxhlet method) or it requires costly equipment like Nuclear Magnetic Resonance or Near Infra Red spectrophotometer. The standardization of these equipments also need much elaborated exercise and it highly depends upon the spectrum of variability present in the material subjected for standardization. In plant breeding programme understanding the relationships between oil yield and other traits is of paramount importance for making the best use of these relationships in selection. There are conflicting reports on the nature of association between these traits (Cherry et al., 1977; Layrisee et al., 1980), which are largely based on limited numbers of genotypes. Hence, there is a need to acquire more information on the nature of the associations exists between these traits. In the present study, the inter-relationship between oil yield and its component traits were studied using F₃ population of three crosses involving low and high oil content parents of groundnut.

Materials and Methods

F₃ population of three crosses involving two high oil genotypes viz., ICGV03128 and ICGV05100, two low oil genotypes viz., ICGV00440 and ICGV07359 and a low oil with high oleic genotype viz., Sunoleic95R (Table 1) were evaluated during Jan – Apr. 2013 at the Oilseeds farm, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. Normal agronomic practices were followed under irrigated condition. The data were recorded for various traits viz., number of branches per plant, number of pods per plant, 100-pods weight (g), 100-kernels weight (g), shell weight (g), shelling %, oil content (%) and oil yield (%). Oil content was estimated using SOCS PLUS Two Place Automatic Solvent Extraction System (Model SCS8 AS) (Make: Pelican Equipments, India) and expressed in per cent and oil yield was obtained by multiplying kernel yield per plant with that of oil content and expressed in grams. Simple correlation coefficients were calculated among traits following standard method.

Results and Discussion

Genetic association plays a significant role to study the interrelationship and relative contribution of different characters towards crop improvement. Simple correlation coefficient between yield and yield components in three crosses of groundnut are presented in Tables 2, 3 and 4.

Oil yield had significant and positive correlation with number of pods per plant, 100-pods weight, 100-kernels weight, shell weight, shelling percentage, and pod yield per plant in the cross...
of oil yield with 100-kernels weight, 100-pods weight, kernel yield per plant and oil content. Lus et al. (2011) and Korat et al. (2010) recorded significant and positive correlation of number of pods per plant with oil yield per plant.

**Association of number of branches per plant with other yield components**

This trait had no significant correlation with any traits. Similar results were reported by Sangha et al. (1990).

**Association of number of pods per plant with other yield components**

In the cross ICGV 00440 x ICGV 03128 pod yield per plant had significant and positive correlation with other yield components.

Table 2. Simple correlation analysis for F3 generation (Cross ICGV00440 X ICGV03128)

<table>
<thead>
<tr>
<th>Characters</th>
<th>Oil content (%)</th>
<th>Oil content (%)</th>
<th>Oil content (%)</th>
<th>Oil content (%)</th>
<th>Oil content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of branches per plant</td>
<td>0.00</td>
<td>0.19</td>
<td>0.18</td>
<td>0.00</td>
<td>0.17</td>
</tr>
<tr>
<td>Number of pods per plant</td>
<td>0.28*</td>
<td>0.37*</td>
<td>0.33*</td>
<td>0.33*</td>
<td>0.37*</td>
</tr>
<tr>
<td>100-kernels weight (g)</td>
<td>0.56*</td>
<td>0.68*</td>
<td>0.51*</td>
<td>0.89*</td>
<td>0.31*</td>
</tr>
<tr>
<td>Shell weight (g) Shell percentage</td>
<td>0.55*</td>
<td>0.64*</td>
<td>0.81*</td>
<td>0.81*</td>
<td>0.38*</td>
</tr>
<tr>
<td>Pod yield per plant (g) Kernel yield</td>
<td>0.00</td>
<td>0.51*</td>
<td>0.33*</td>
<td>0.26*</td>
<td>0.19</td>
</tr>
<tr>
<td>Oil content (%)</td>
<td>0.35*</td>
<td>0.44*</td>
<td>0.67*</td>
<td>0.97*</td>
<td>0.19</td>
</tr>
</tbody>
</table>

*Significant at 5% level

100-pods weight, 100-kernels weight, shell weight, shelling percentage and pod yield per plant. In case of ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with 100-pods weight, 100-kernels weight, shell weight, shelling percentage, pod yield per plant, kernel yield per plant and oil content. In the cross ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with pod yield per plant, kernel yield per plant and oil content. In the cross ICGV 05100 x Sunoleic95R, this trait had significant and positive correlation with pod yield per plant, kernel yield per plant and oil content. In the cross ICGV 05100 x Sunoleic95R, this trait had significant and positive correlation with pod yield per plant, kernel yield per plant and oil content.

**Association of 100-pods weight with other yield components**

In the cross ICGV 00440 x ICGV 03128, 100-pods weight had significant and positive correlation with 100-kernels weight, shell weight, shelling percentage, pod yield per plant, kernel yield per plant and oil content. In case of cross ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with pod yield per plant, kernel yield per plant and oil content. In the cross ICGV 05100 x Sunoleic95R, this trait had significant and positive correlation with 100-kernels weight, shell weight,
Association of kernel yield per plant with other yield components

The trait significant and positive association with kernel yield per plant.

Association of pod yield per plant, kernel yield per plant and oil content. Kotzamanidis et al. (2006) observed that 100-kernels weight was significantly and positively associated with 100-pods weight. Vasanthi et al. (1998) recorded significant and positive association of shelling percentage with 100-pods weight.

Association of 100-kernels weight with other yield components

The trait hundred kernels weight recorded significant and positive correlation with shell weight, pod yield per plant, kernel yield per plant and oil content. Nagda et al. (2001) and Venkataramana et al. (2000) observed that 100-kernels weight was significantly and positively associated with shelling percentage. Significant positive association of this trait with pod yield per plant was recorded by John et al. (2009), Pradhan and Patra (2011), Zaman et al. (2011) and Priyadharshini (2012).

Shell weight had significant and positive correlation with shelling percentage, pod yield per plant, kernel yield per plant and oil content in all the three crosses viz., ICGV 00440 x ICGV 03128, ICGV 07359 x ICGV 05100 and ICGV 05100 x Sunoleic95R. Mohinder Singh et al. (2000) and Venkataramana et al. (2000) observed that 100-kernels weight was significantly and positively associated with shelling percentage. Significant positive association of this trait with pod yield per plant was recorded by John et al. (2009), Pradhan and Patra (2011), Zaman et al. (2011) and Priyadharshini (2012). Sadeghi and Niyaki (2012b).

Table 3. Simple correlation analysis for F2 generation (Cross ICGV07359 x ICGV05100)

<table>
<thead>
<tr>
<th>Characters</th>
<th>NO. of branches per plant</th>
<th>NO. of pods per plant</th>
<th>100-pods weight (g)</th>
<th>100-kernels weight (g)</th>
<th>Shell weight (g) Shelling percentage Pod yield per plant</th>
<th>Kernel yield per plant</th>
<th>Oil content (%)</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of branches per plant</td>
<td>-0.57*</td>
<td>-0.41</td>
<td>-0.33</td>
<td>-0.35</td>
<td>-0.26</td>
<td>-0.48*</td>
<td>-0.31</td>
<td>-0.30</td>
</tr>
<tr>
<td>Number of pods per plant</td>
<td>0.50*</td>
<td>0.77*</td>
<td>0.66*</td>
<td>0.77*</td>
<td>0.84*</td>
<td>0.62*</td>
<td>0.60*</td>
<td>0.86*</td>
</tr>
<tr>
<td>100-pods weight (g)</td>
<td>0.28</td>
<td>0.34</td>
<td>0.16</td>
<td>0.66*</td>
<td>0.85*</td>
<td>0.89*</td>
<td>0.60*</td>
<td></td>
</tr>
<tr>
<td>100-kernels weight (g)</td>
<td>0.96*</td>
<td>0.91*</td>
<td>0.69*</td>
<td>0.63*</td>
<td>0.54*</td>
<td>0.74*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell weight (g) Shelling percentage Pod yield per plant</td>
<td>0.75*</td>
<td>0.82*</td>
<td>0.63*</td>
<td>0.62*</td>
<td>0.77*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kernel yield per plant</td>
<td>0.42</td>
<td>0.54*</td>
<td>0.35</td>
<td>0.60*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil content (%)</td>
<td>0.72*</td>
<td>0.80*</td>
<td>0.85*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(%) *Significant at 5%</td>
<td>0.96</td>
<td>0.68*</td>
<td>0.67*</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Table 4. Simple correlation analysis for F3 generation (Cross ICGV05100 X Sunoleic95R)

<table>
<thead>
<tr>
<th>Characters</th>
<th>NO. of branches per plant</th>
<th>NO. of pods per plant</th>
<th>100-pods weight (g)</th>
<th>100-kernels weight (g)</th>
<th>Shell weight (g) Shelling percentage Pod yield per plant</th>
<th>Kernel yield per plant</th>
<th>Oil content (%)</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of branches per plant</td>
<td>-0.23</td>
<td>0.11</td>
<td>-0.25</td>
<td>-0.13</td>
<td>-0.36*</td>
<td>-0.16</td>
<td>0.09</td>
<td>0.12</td>
</tr>
<tr>
<td>Number of pods per plant</td>
<td>-0.28</td>
<td>0.46*</td>
<td>0.32*</td>
<td>0.54*</td>
<td>0.32*</td>
<td>-0.08</td>
<td>-0.12</td>
<td>0.56*</td>
</tr>
<tr>
<td>100-pods weight (g)</td>
<td>0.38*</td>
<td>0.52*</td>
<td>-0.28</td>
<td>0.59*</td>
<td>0.93*</td>
<td>0.94*</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>100-kernels weight (g)</td>
<td>0.92*</td>
<td>0.52*</td>
<td>0.71*</td>
<td>0.59*</td>
<td>0.54*</td>
<td>0.47*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell weight (g) Shelling percentage Pod yield per plant</td>
<td>0.15</td>
<td>0.82*</td>
<td>0.70*</td>
<td>0.70*</td>
<td>0.33*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kernel yield per plant</td>
<td>-0.04</td>
<td>-0.12</td>
<td>-0.23</td>
<td>0.47*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil content (%)</td>
<td>0.64*</td>
<td>0.66*</td>
<td>0.49*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(%) *Significant at 5%</td>
<td>0.99*</td>
<td>0.02</td>
<td>0.00</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Jogloy et al. (2010) and Kotzamanidis et al. (2006) observed that 100-kernels weight was significantly and positively associated with oil content.

Association of shell weight and shelling percentage with other yield components

Shell weight had significant and positive correlation with shelling percentage, pod yield per plant, kernel yield per plant and oil content in the cross ICGV 00440 x ICGV 03128. In the cross ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with shelling percentage, pod yield per plant, kernel yield per plant and oil content. Shelling percentage had significant and positive correlation with kernel yield per plant and oil content in the cross ICGV 00440 x ICGV 03128. In the cross ICGV 07359 x ICGV 05100, this trait had significant and positive correlation with kernel yield per plant. Venkataramana et al. (2012), Narasimhulu et al. (2012), Ladole et al. (2009) and Kotzamanidis et al. (2006) noticed that significant association of pod yield for this trait. Dhalial et al. (2010), John et al. (2008) Nagda et al. (2001) and Venkataramana et al. (2000) observed that kernel yield per plant was significantly and positively associated with shelling percentage.

Association of pod yield per plant with other yield components

The trait pod yield per plant recorded significant and positive correlation with kernel yield per plant and oil content in all the three crosses viz., ICGV 00440 x ICGV 03128, ICGV 07359 x ICGV 05100 and ICGV 05100 x Sunoleic95R. Kumar et al. (2012), Narasimhulu et al. (2012), Priyadharshini (2012), Sharma and Dashora (2009) and John et al. (2008) observed that significant and positive association of pod yield with kernel yield per plant. Mahalakshmi et al. (2005) observed that pod yield per plant was significantly and positively associated with oil content.

Association of kernel yield per plant with other yield components

In all the three crosses, this trait had significant
and positive relationship with oil content. The cross ICGV 07359 x ICGV 05100 had significant and positive correlation with oil yield per plant. Sadeghi and Niyaki (2012a) found significant and positive relationship between kernel yield with oil yield per plant.

It is therefore, logical to conclude that for improving the oil yield per plant in groundnut, selection has to be exercised on number of branches per plant, number of pods per plant, 100-kernels weight, shell weight, shelling percentage and pod yield per plant. The inter correlation among these traits also has significant association. Hence, these traits may be considered as selection indices for oil yield improvement programme in groundnut.

References


Received: August 6, 2013; Revised: December 12, 2014; Accepted: December 17, 2014