Performance Based Evaluation of Groundnut Genotypes Under Medium Rainfall Conditions of Chakwal

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ABSTRACT

Groundnut (Arachis hypogaea L.) is one of the most important summer leguminous crops of the Potohar region. About 90% of the groundnut production is obtained from rainfed region which covers more than 90% of total cultivated area under groundnut cultivation in Punjab. A study was conducted at Barani Agricultural Research Institute (BARI), Chakwal in the years 2009 and 2010 to evaluate the performance of the groundnut genotypes for yield and other characters under rainfed condition. Seven promising/candidate lines of groundnut obtained from National Agricultural Research Centre (NARC), Islamabad and BARI, Chakwal were sown in first week of April in Randomized Complete Block Design with three replications. The results revealed that varieties BARI-2011 and PG-1102 produced higher pod yield of 3648 and 3617 kg ha$^{-1}$, respectively with better yield components. Both these varieties are recommended for commercial cultivation in rainfed areas.

Keywords: Groundnut, Evaluation, Medium rainfall, Yield performance.

INTRODUCTION

Groundnut (Arachis hypogaea L.) is one of the most important leguminous crops. Its kernel is rich in both oil (45% to 50%) and digestible protein (25% to 30%) (Nath and Alam 2002; Ahmad and Rahim, 2007). Being a legume crop, groundnut enriches soil by fixing nitrogen without draining the nonrenewable energies and without upsetting the agro-ecological balance (Reddy and Kaul, 1986). Groundnut crop ranks 13th in importance in the world.

In Pakistan, it is mostly used as roasted nuts and confectionery. During 2007-2009 area under groundnut crop in Pakistan was 92.8 thousands hectares with annual production of 85.5 thousand tonnes (Anonymous). It is the most important summer season cash crop of the Potohar region. Its cultivation is generally limited in rainfed areas. The districts of Chakwal, Attock, Jhelum and Rawalpindi in Punjab, Karak and Swabi in NWFP and Sahngar in Sindh are the groundnut major growing areas in the country (Khan, 2010). The average yield of groundnut is far below its potential yield and more than 70% of potential yield has not been achieved (Hatam and Abbasi, 1994).

The low yield of groundnut crop in Pakistan has been attributed to the diverse climatic conditions and use of low yielding varieties (Khan et al., 2009). Varieties play a vital role in the success of groundnut crop. The yield of groundnut can be increased up to 30% - 89% provided high yielding varieties are identified (Reddy et al., 1993). There is a dire need of approved genotypes for rainfed areas of Pakistan. Introducing high yielding groundnut varieties may be a new device to increase yield under rainfed condition which will make groundnut a lucrative crop in rainfed areas of Pakistan (Khan et al., 2001).

(Santos, 1998) indicated that BRS151 Amendoin L 7 is a large seeded groundnut variety for Brazil with average pod yield of 1850 kg under rainfed and 4500 kg ha$^{-1}$ under irrigated condition. (Ahmad and Rahim ,2007) evaluated that varieties PG-479 and PI-338337 produce higher pod yield of 4024 and 3703 kg ha$^{-1}$, respectively with better yield component in Malakand division. (Shah et al., 1993) reported that yield was positively correlated with pods per plant and seeds per pod.
The present study was aimed to evaluate groundnut genotypes for its yield and yield components under rainfed condition.

**MATERIALS AND METHODS**

Seven promising/candidate lines were evaluated at Barani Agriculture Research Institute Chakwal, during the year 2009 & 2010. Seed of these varieties was obtained from NARC, Islamabad and BARI, Chakwal. The trial was sown in first week of April in Randomized Completed Block Design with three replications. The plot size was kept at 4 m x 1.8 m. The rows were spaced at 45 cm apart while the plant spacing within rows were maintained at 20 cm. Fertilizers @ 20-80-20 kg NPK ha\(^{-1}\) were applied before sowing. Gypsum @ 500 kg ha\(^{-1}\) was also applied at flowering stage. Digging of pods was started at maturity. The plants from each plot were labeled and kept separately. The observations recorded for yield and yield components during the course of trial included: Plant height (cm), Days to maturity, Pod yield (kg ha\(^{-1}\)), 20-pods length (cm), 100-kernels weight (g) and Pods plant\(^{-1}\).

**Data collection and analysis**

**Plant height or spread (cm)**

Height or spread of five representative plants from each subplot from ground level to the plant growing tip was measured in cm to record height or spread of plant (Khan et al., 2009).

**Days to maturity**

For recording days to maturity at the end of flowering stage in each subplot, 2-3 plants were uprooted. The number of mature pods (mature pod is one which shows dark brownish and yellow veins on the inner side of shell with brownish yellow kernel testa) of the total were counted. When plants showed an average of more than 60% mature pods, it was considered best time for recording maturity data (Khan et al., 2009).

**Pod yield (kg ha\(^{-1}\))**

In order to record pod yield (kg ha\(^{-1}\)), plants of each subplot were harvested, sun dried and weighed to record pod yield per subplot. Then converted into pod yield (kg ha\(^{-1}\)) by using following formula (Khan et al., 2009):

\[
\text{Pod yield (kg)} = \frac{\text{Pod yield (kg ha}^{-1}\text{)}}{\text{Subplot size (m}^2\text{)}} \times 10,000 \text{ m}^2
\]

**100-kernels weight**

The 100 kernel weight is a measure of seed size. It is the weight in grams of 100 seeds.

**Pods plant\(^{-1}\)**

In order to record pods plant\(^{-1}\) data, plants were harvested and No. of pods plant\(^{-1}\) were counted and recorded.

**20-pods length**

For recording data to 20-pods length, randomly selected 20 pods of plant and were placed in vertical position along with measuring scale.

Means values for different plant characteristics were compared through LSD test (Johnson et al., 1956).

**RESULTS AND DISCUSSION**

**RESULTS**

**Maturity and Plant height**

Days to maturity remained non-significant (Table 1). However, genotypes PG-1102 and PG-1092 were matured earlier than others. Maximum plant height (38cm) was recorded for PG1104, while minimum (19cm) for check variety Golden.

**20-pods length and 100-kernels weight**

Twenty pods length showed a significant difference among various genotypes (Table 1). Varieties PG-1092 and BARI-2011 had maximum 20-pods length (72 cm), while check variety Golden had minimum (57 cm) 20-pods length. Data on 100-Kernels weight showed significant differences. Maximum 100-kernels weight was recorded for PG-1104 (63.3g) following by BARI-2011 (60.7g) while minimum 100 kernels weight of 47.3g was recorded for check variety Golden.

**Pods plant\(^{-1}\) and Pod yield**
Data presented in Table 1 further revealed significant differences (P=0.05) in pods plant\(^{-1}\) and pod yield. (Ahmad and Rahim, 2007) pointed out significant differences for pod yield, 100 kernel weight and pods plant\(^{-1}\). Maximum No. of pods (45) were recorded for BARI-2011, followed by PG-1102 (42.3) while PG-1104 had minimum No. of pods plant\(^{-1}\) (21). BARI-2011 had maximum pod yield (3648 kg ha\(^{-1}\)) while minimum pod yield (2825 kg ha\(^{-1}\)) was recorded for PG-1104.

**Correlation between yield components**

Correlation analysis provides the information of interrelationship of important plant characters and hence, leads to a directional model for direct and indirect improvement in grain yield (Khan et al., 2004). The simple correlation coefficient (Table 2) for days to maturity showed negative correlation with pods plant\(^{-1}\), 20 pods length, 100 kernel weight and yield. Pods plant\(^{-1}\) indicates positive correlation with 20 pods length and yield while negative with 100 kernel weight. 20 pods length exhibited positive correlation with yield and negative with 100 kernel weights. Hundred kernel weights showed positive correlation with yield.

**DISCUSSION**

Plant height showed significant differences (P=0.05). (Ahmad and Rahim ,2007) also observed non-significant differences among groundnut genotypes for maturity but a significant difference exist for plant height. The variation in plant height may be attributed to specific genetic characteristics of these varieties. Genetic character of each variety played dominant role for pod length and 100 kernel weight. However, this could also be attributed to change in soil fertility and soil structure and texture (Ahmad and Rahim, 2007). (Karkannavar et al., 1991) reported that seed trait was genetically heritable. Variation regarding pods per plant and pod yield among different varieties could be explained in terms of pods plant\(^{-1}\). As yield is positively correlated with pods plant\(^{-1}\) (Shah et al., 1993) BARI-2011 and PG-1102 with higher number of pods plant\(^{-1}\) produced higher pod yield. Celal (2004) also pointed out positive relationship for seed yield with pods plant\(^{-1}\) and 1000 seed weight and pods plant\(^{-1}\).

### Table 1. Performance of different groundnut genotypes for yield and yield related traits

<table>
<thead>
<tr>
<th>Variety</th>
<th>Days to maturity</th>
<th>Plant height (cm)</th>
<th>20-pods length (cm)</th>
<th>100-kernels weight (g)</th>
<th>pods plant(^{-1})</th>
<th>Yield (kg ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golden (check)</td>
<td>192.0</td>
<td>19</td>
<td>57</td>
<td>47.3</td>
<td>37.3</td>
<td>2964</td>
</tr>
<tr>
<td>PG-1102</td>
<td>190.3</td>
<td>28</td>
<td>63</td>
<td>60.67</td>
<td>42.3</td>
<td>3617</td>
</tr>
<tr>
<td>PG-1092</td>
<td>190.0</td>
<td>29</td>
<td>72</td>
<td>53.0</td>
<td>40.0</td>
<td>2992</td>
</tr>
<tr>
<td>BARI-2011</td>
<td>191.0</td>
<td>35</td>
<td>72</td>
<td>52.0</td>
<td>45.0</td>
<td>3648</td>
</tr>
<tr>
<td>BARD-479</td>
<td>191.3</td>
<td>33</td>
<td>71</td>
<td>52.3</td>
<td>33.7</td>
<td>2947</td>
</tr>
<tr>
<td>PG-492</td>
<td>192.0</td>
<td>30</td>
<td>63</td>
<td>53.3</td>
<td>33.0</td>
<td>2866</td>
</tr>
<tr>
<td>PG1104</td>
<td>191.3</td>
<td>38</td>
<td>60</td>
<td>63.3</td>
<td>21.0</td>
<td>2825</td>
</tr>
<tr>
<td>LSD(0.05)</td>
<td>NS*</td>
<td>1.50</td>
<td>8.78</td>
<td>3.71</td>
<td>2.46</td>
<td>128.5</td>
</tr>
</tbody>
</table>

*NS* = Non-significant

### Table 2. Correlation for yield and yield related traits of groundnut varieties

<table>
<thead>
<tr>
<th></th>
<th>Days to maturity</th>
<th>pods plant(^{-1})</th>
<th>20-pod weight</th>
<th>100 –kernel weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days to maturity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pods plant(^{-1})</td>
<td>-0.28054</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20pod length</td>
<td>-0.54057</td>
<td>0.414499</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>100 –kernel weight</td>
<td>-0.43743</td>
<td>-0.4644</td>
<td>-0.54057</td>
<td>-</td>
</tr>
<tr>
<td>Yield</td>
<td>-0.22763</td>
<td>0.691232</td>
<td>0.194658</td>
<td>0.104459</td>
</tr>
</tbody>
</table>

**CONCLUSION**

Evaluating the performance of the groundnut genotypes for yield and other characters under rainfed condition revealed that varieties BARI-2011 and PG-1102 produced higher pod yield of 3648 and 3617 kg ha\(^{-1}\), respectively with better yield components. It is also observed that average performance of genotypes could not exceed from the genotype BARI-2011, which was approved during 2011 for general cultivation to the farmers of rainfed areas of Punjab.

**REFERENCES**
