

Research Application Summary

**Genetic variability of soybean for yield and yield components under irrigation conditions of Gezira, Sudan**

Mohamed Yousif Balla<sup>1</sup> & Seifeldin Elrayah, I.<sup>1</sup>

<sup>1</sup>Oil Seed Crop Research Center, Agricultural Research Corporation, (ARC), Sudan, Wad Medani.  
P.O. Box 126 Wad Medani, Sudan

Corresponding author: mohammedballa83@yahoo.com

**Abstract**

A field experiment was conducted to study the genetic variability among 21 soybean varieties at the Gezira Research Station Farm, Sudan for two successive seasons in 2009 and 2010. Six traits were studied including grain yield/ha, days to 50 flowering, days to maturity, plant height, height to first pod and number of pods/plant. Individual analysis of variance revealed highly significant differences among the 21 genotypes in all studied traits. Grain yield ranged from 2709-1200 kg/ha. The heritability ( $h^2$ ) estimates ranged from 43% to 85%. The highest estimates were given by days to maturity and plant height.

Key word: Genetic variability, grain yield, soybean, Sudan

**Résumé**

Une expérience de terrain a été menée pour étudier la variabilité génétique parmi les 21 variétés de soja à la ferme de Gezira (Gezira Research Station Farm) Station de recherche, au Soudan pendant deux saisons successives en 2009 et 2010. Six caractéristiques ont été étudiées, y compris le rendement en grains / ha, les jours à 50 floraisons, les jours jusqu'à la maturité, la hauteur des plantes, la hauteur de la première gousse et le nombre de gousses par plante. L'analyse individuelle de variance a révélé des différences très significatives entre les 21 génotypes de tous les caractères étudiés. Le rendement en grain allant de 2709-1200 kg / ha. Les estimations de l'héritabilité ( $H^2$ ) vont de 43% à 85%. Les estimations les plus élevées ont été données par la précocité et la hauteur des plantes.

Mot clés: La variabilité génétique, le rendement en grain, le soja, le Soudan

**Background**

Examination of genetic variability is important for plant breeders in general and particularly in a new introduced crop like soybean, which is not grown commercially in Sudan. Introduced germplasms are an important source for developing improved high-yielding varieties (Donget *al.*, 2001). During the last four decades soybean research in Sudan has been received

discontinuous attention. Based on previous research results, late maturity varieties were assessed for performance across different agro-ecological zones in Sudan. This study aimed at estimating the genetic variability among 21 promiscuous soybean varieties, studied the interrelationship between different characters to expedite selection of varieties with desirable combinations characters.

## Literature Summary

Soybean (*Glycine Max* L. Merr.) is a legume that grows in tropical, subtropical and temperate climates. In Sudan it is considered as one of the most promising crops which could be introduce into irrigated and rain-fed areas to provide a new source of protein, edible oil for local farmers, improve soil fertility and reduce high costs of the nitrogen fertilizer.

Genetic variability is essential for successful crop improvement. Understanding of genetic variability is of great importance, because this makes breeding work easier by enabling the selection of the best genotypes in different generations (Skaloud and Kovacik, 1994). Indeed, genetic variability is a key component of any agricultural production system (Brown, 1978; Frankel and Souel, 1981; Frankel, 1984; Frankel *et al.*, 1995). In soybean, grain yield, as in other crops, is a complex character, which is dependent on a number of variables (Dong *et al.*, 2001). Many of previous studies indicated that there were positive associations between number of pods per plant, days to maturity and seed yield in soybean (Jadhav *et al.*, 1995). The present work aimed at studying the soybean germplasm for its genetic variability and to evaluate the performance of different genotypes. This information would ultimately lead to the determination of suitable plant types available for further studies in soybean.

## Study Description

The experiment was conducted at the Gezira Research Station Farm in Agricultural Research Corporation (ARC), Sudan for two successive season in 2009-2010. The material consisted of 21 soybean genotypes grown in a randomized complete block design with four replications. Each plot consisted of four-rows 6m long, with row to row distance of 0.8m apart. Data were recorded on days to 50% flowering, days to 90% maturity, plant height, grain yield, number of pods per plant, height to first pod and Hay weight. SAS Software programme was used for the analysis of variance (SAS Institute, 2003).

## Research Application

Considerable genetic variability existed among the 21 soybean genotypes. There were significant differences among genotypes for all characters under study (Table 1). The highest yield of (2709 kg/ha) was obtained in soy 1937-1F followed by 1955-4F with 2678 kg/ha and least in PI-3 (1200kg/ha). The days to maturity ranged between 101 and 118 days. Maximum plant height of 68 cm was observed in 1955-4F followed by 1437-1F, PI 4, TR9 (65 cm), and 1954-IF (64 cm). The highest value of first pod height was 17cm in genotype 1955-4F and least (12 cm) in PI9. Maximum number of pods per plant (69) was observed in 1955-4F followed by (67) in PI 10, and least (36) in PI 18. High value of genetic advance percentage for grain yield (17.9%) and Hay weight (11.9%) were obtained and estimates of heritability ranged from 43% to 85% (Table 2). The above results are being reviewed to identify genotypes for further evaluations.

**Table 1. Mean yield components of 21 genotype of soybean grown in Gezira, Sudan.**

| Genotype | DFR | YLD<br>(kg/ha) | MAT | HAY<br>(g) | PHT<br>(cm) | HFP<br>(cm) | NPP |
|----------|-----|----------------|-----|------------|-------------|-------------|-----|
| 1945-1f  | 44  | 2304           | 110 | 329        | 62          | 14          | 53  |
| 1954-1F  | 46  | 1824           | 109 | 2938.6     | 64          | 14          | 42  |
| 1951-4F  | 47  | 2530           | 110 | 4105.6     | 63          | 14          | 49  |
| 1932-1F  | 42  | 1885           | 111 | 3152.6     | 61          | 15          | 55  |
| 1935-3F  | 43  | 2206.3         | 114 | 3177.3     | 62          | 14          | 49  |
| 1955-4F  | 46  | 2678.3         | 113 | 4052.3     | 68          | 17          | 69  |
| 1949-7F  | 45  | 1629           | 115 | 2940.3     | 59          | 13          | 41  |
| 1935-5F  | 43  | 2189.3         | 112 | 3423       | 36          | 14          | 44  |
| 1937-1F  | 45  | 2709           | 111 | 35566      | 65          | 15          | 62  |
| 1939-2F  | 45  | 2103.3         | 118 | 3430.3     | 62          | 16          | 51  |
| 1950-8F  | 47  | 2221.6         | 116 | 3607.3     | 62          | 14          | 53  |
| PI-2     | 43  | 1787.3         | 110 | 4300       | 57          | 13          | 44  |
| PI-9     | 45  | 1590           | 112 | 2845.6     | 57          | 12          | 37  |
| TR6      | 44  | 1735           | 112 | 2630.3     | 61          | 13          | 46  |
| PI-18    | 46  | 1547.3         | 111 | 2577.6     | 58          | 12          | 37  |
| PI-3     | 40  | 1200           | 101 | 2477       | 60          | 16          | 36  |
| PI-10    | 41  | 1379           | 108 | 2600       | 60          | 14          | 67  |
| PI-4     | 42  | 1456.5         | 103 | 2568       | 65          | 14          | 57  |
| TR9      | 43  | 2020.6         | 108 | 2990.3     | 65          | 15          | 56  |
| TR11     | 42  | 1824           | 109 | 2938       | 64          | 15          | 42  |
| Gizza111 | 14  | 1638           | 109 | 2587       | 59          | 15          | 42  |
| Mean     | 44  | 1930           | 111 | 3122       | 62          | 15          | 49  |
| Sig      | **  | **             | **  | **         | **          | **          | **  |
| CV (%)   | 1.7 | 6.21           | 1.2 | 5.43       | 3           | 4.2         | 12  |

DFR = days to 50% flowering; YLD = Grain yield (g); MAT = days to maturity; HAY = Hay weight (g); PHT = plant height (cm); HFP = height to first pods (cm); NPP = number of pods per plant.

**Table 2. Estimate of genotypic and phenotypic coefficients of heritability variability and genetic advance in soybean.**

| Treatments | MSE       | $h_2$ B.S% | PCV | GCV | GA   | GA % |
|------------|-----------|------------|-----|-----|------|------|
| DFR        | 21        | 77         | 22  | 19  | 16   | 3.4  |
| YLD        | 574353    | 85         | 102 | 94  | 3458 | 17.9 |
| MAT        | 86.6      | 84         | 17  | 16  | 33   | 3.0  |
| HAY        | 1149332.8 | 78         | 74  | 65  | 3719 | 11.9 |
| PHT        | 103.7     | 59         | 59  | 20  | 20   | 3.1  |
| HFP        | 15.06     | 58         | 40  | 31  | 7.21 | 4.8  |
| NPP        | 1383      | 43         | 132 | 66  | 43   | 8.9  |

MSE = mean square of Error; ( $h_2$  B.S) = heritability (broad since); PCV = phenotypic coefficients of variability; GCV = genotypic coefficients of variability; GA = genetic advance.

## Acknowledgement

This study is funded by SCARDA-ECA as part of M.Sc. study of the first author. We thank ARC for the technical guidance, especially Prof. Dr.Kamal Alsiddig and Dr. Ibrahim Aldekhiry.

## References

- Brown, A.D.H. 1978. Isozymes, plant population genetic structure and genetic conservation. *Theor.Appl. Genet.* 52:145-147.
- Dong, Y.S., Zhuang, B.C., Zhao, L.M., Sun, H. and He, M.Y. 2001. The genetic diversity of annual wild soybeans growing in china. *Theor.Appl. Genet.* 103 (1):98 -103.
- Frankel, O.H., Brown, A.D.H. and Burdon, J.J. 1995. The conservation of plant biodiversity. Cambridge Uni. Press, Cambridge. UK. pp. 299.
- Jadhav, A.S., Jadhav, P.J. and Bachehhav, S.M. 1995. Correlation and path coefficient analysis in soybean. *J. Maharashtra Agric. Univ.* 20:150–151.
- SAS Institute, 2003. The SAS system for Windows, release 9.1. SAS Institute, Cary, N.C. USA.
- Skaloud, V. and Kovacik, A. 1994. Findings on sunflower self-fertility in connection with line hybridization. *Helia*17(20):13-20.