

Effect of Nitrogen and Phosphorus Fertilization on Yield and its Attributes for Some Peanut Varieties in Sandy Calcareous Soil
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Abstract:

Two field experiments were carried out at El-Ghorieb Exp. Farm, Agriculture Fac., Assiut Univ., Egypt, during the summer of 2009 and 2010 seasons to investigate the effect of three nitrogen rates (15, 25 and 35 kg N/fed.) and three phosphorus rates (15.5, 23 and 31 kg P₂O₅/fed.) on the yield and its attributes for three peanut varieties (Giza 9 as spreading group), Giza 5 and Giza 6 as erect groups), grown in sandy calcareous soil. The results could be summarized as follows:

- Giza 9 had the tallest plants and gave the maximum mean values for 100-seed weight and pods yield/fed., in the 2nd and the 1st seasons, respectively, however Giza 6 had the maximum mean values for the traits, i.e. Pods weight/plant, fodder yield/fed. and biological yield/fed. in the both seasons.

- The highest phosphorus application (31 kg P₂O₅/fed.) increased pods yield/fed. and its attributes as compared to the minimum one (15.5 kg P₂O₅/fed.).

- The tallest plant and the maximum mean values for the yield and its attributes were obtained from the highest nitrogen fertilizer rate (35 kg N/fed.)

- Generally, the both highest rates of phosphorus and nitrogen fertilization (P₃xN₃) interaction gave the tallest plants and the maximum mean values for number of branches/plant, fodder yield and biological yield. As well as, the above traits affected significantly by the interactions for varieties Giza 9 (V₁) and Giza 6 (V₃) with both the highest rates of phosphorus and nitrogen fertilization i.e. V₁xP₃ or V₃xP₃ and V₁xN₃ or V₃xN₃, since gave the highest values.

Kew words: peanut, varieties, P and N fertilization and sandy calcareous soil.

Received on: 12 /6/2013

Accepted for publication on: 27/6 /2013

Referees: Prof. El Saadi A. Ali

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Introduction:

Peanut is considered to be one of the most important leguminous crops in Egypt. Peanut was grown in Egypt for oil production, fresh human consumption or for export, since its cultivation is thrived in the reclaimed sandy soil. In addition, it has the ability for improving the physical structure as well as the fertility of such soil types. So many investigations carried out to raise peanut quantity and quality in sandy soil. Varieties of peanut different in growth habit where some of them are semi-spreading and others are erect. Their root system may vary in volume and size and may be of different capabilities to absorb nutrients. Ahmed and Zeidan (2001) found that Giza 5 surpassed Giza 4 in number of pods/plant, 100-seed weight and pods yield kg/fed., on the other hand, Giza 4 gave the heaviest total dry weight/plant. Migawer, Ekram and Soliman, Mona (2001) reported that Giza 5 surpassed Giza 4 in all studied characters except plant height. Abd-Alla, Maha (2004) showed that NG12 cultivar produced the highest and heaviest number of branches, pods and seeds/plant, weight of pods/plant and biological yield/fed. compared with the other cultivars. Frimpong (2004) found that number of branches/plant ranged from (10 to 32) and forage yield (from 1898 to 3220 kg/ha) for SARGV 0309 and SARGV 0319 cultivars, respectively. Ahmed and Rahim (2007) showed that the maximum plant height (62.1 cm), pods/plant (45.03) and pods yield/fed. were recorded for varieties PG 951, PG 479 and PG 479, respectively, while the minimum ones were obtained from varieties PG 479, PG 951 and PG 481, respectively. Kathirvelan (2007) showed that significant

differences among the groundnut varieties (TG 41, TG 42, CO3 and VRI2) in number of branches/plant, during both seasons. Caliskan *et al.* (2008) mentioned that there was a significant differences among eight varieties of peanut in 100-seed weight and pods yield/fed., Mohamed (2009) and Osman & Abdel-Motagally (2009) concluded that significant differences between the three genotypes of peanut in most studied traits. N.A. 623 genotype surpassed the other two genotypes in the plant height, pods yield/plant, 100-seed weight and pods yield/fed.

The phosphorus application had the different effective on the characters of peanut. Phosphorus is essential for improving productivity of crops. It is also believing that groundnut requires large quantities of phosphorus, calcium and sulphur for seed development and oil quantity. Because nutrients are removed and consequently lost as result of cropping with crop harvest, there is need to replace lost nutrients through the application of inorganic fertilizer in order to maintain a positive nutrient. Phosphorus fertilization was investigated by several workers, about yield and its attributes i.e. 100-kernel weight, but did not affect pod weight (Rekha and Reddy, 2002). Similar findings were reported by Akbari *et al.* (2003), Maity *et al.* (2004), Nguyen (2004), Osman and Abdel-Motagally (2009) and Shiyam (2010) who concluded that the highest values of the studied traits were obtained by 40 kg P₂O₅/ha.

Nitrogen has a critical role in producing agricultural products and selecting the amount of nitrogen-containing fertilizers is necessary for producing the highest production level. Nitrogen is the main element in

the chlorophyll synthesis and its fixation could lead to more growth of aerial plants. Wen *et al.* (2002) reported that a highly effective N-fertilizer application management program for crop production on the sandy soil is possible. Similar findings were stated by Basyouny *et al.* (2004), Sakena *et al.* (2004), Lanier *et al.* (2005), and Moraditochae (2012) who mentioned that seed yield, fodder yield and biological yield were increased with increase nitrogen application up to 75 kg N/ha.

This study aimed to evaluate the response of yield and its attributes of some peanut varieties to nitrogen and phosphorus fertilizer rates cultivated in sandy calcareous soil.

Materials and Methods:

Two field experiments were carried out at El-Ghorieb Exp. Farm, Agriculture Fac., Assiut Univ., Egypt, during the summer of 2009 and 2010 seasons to investigate the effect of nitrogen and phosphorus fertilization on yield and its attributes for some peanut varieties in sandy calcareous soil. The soil of experimental site is sandy calcareous with pH (8.0), total N % (0.4), CaCO₃ % (14.5), ECe (1.62 ds/m), organic matter % (0.6) and field capacity % (15.1). The experimental design was split-split-plot in a randomized complete block design with four replicates. The three peanut varieties (Giza 9, Giza 5 and Giza 6) arranged in main plots. The three phosphorus fertilizer rates (15.5, 23 and 31 kg P₂O₅/fed.) were occupied the sub-plot. The three nitrogen fertilizer rates (15, 25 and 35 kg N/fed.) were placed on sub-sub-plots. The preceding crop was wheat in both seasons. The experimental unit area was 10.5 m² and contained 5 ridges; 60 cm apart and 3.5 m long. Seeds were inoculated with the spe-

cific *Rhizobium japonicum* strain before the sowing. Seeds were sown by hand on one side of the ridges (3-4 seed in each hill) on May 11 and 25 in 2009 and 2010 seasons, respectively. After two weeks of germination, seedlings were thinned to 2 plants/hill. The recommended rate 500 kg gypsum/fed. was added during soil preparation. Nitrogen as ammonium nitrate (33.5 kg N/fed.) as well as phosphorus as super phosphate (15.5 P₂O₅) was added in two equal doses at 20 and 45 days after sowing. All recommended agricultural practices were adopted throughout both growth seasons.

At harvest, a sample of five guarded plants was taken randomly from each sub-sub-plot to determine plant height, the number of branches/plant and weight of pods/plant. In addition, after pod drying the following characters were estimated; pods yield/fed. and biological yield ton/fed. (calculated on plot basis) and 100-seeds weight (estimated from 100 random pods).

Statistical Analysis:

All the obtained data were subjected to analysis of variance according to method described by Gomez and Gomez (1984). The least significant difference (LSD) at 5% level of significance to compare differences among means was used.

Results and Discussion:

Main Effect

Data in Table 1 revealed that the varieties, phosphorus and nitrogen fertilization had a significant or highly significant effects on one of the all studied traits i.e. plant height, number of branches/plant, pods yield and its attributes and fodder and biological yields/fed., in the summer growing seasons 2009 and 2010, except number of branches/plant in the

second season or plant height and biological yield/fed. in the second season and pods yield/fed. in the first season as well as pods yield/fed. in both seasons for varieties, phosphorus and nitrogen fertilization, respectively, had non-significance effect.

Generally, Giza 9 variety had the tallest plants in both seasons, maximum 100-seed weight in 2nd season, and maximum pods yield/fed. in the 1st season. Giza 6 variety had the maximum values for the traits, i.e. pods weight/plant, fodder yield/fed. and biological yield/fed. in both seasons or for 100-seed weight and pods yield/fed. in the 1st and 2nd seasons, respectively, while it had the shortest plants in both seasons, however Giza 5 variety had the maximum number of branches/plant in the 1st season only (Table 1). Also, the results showed that the varieties had different behaviour for the studied traits and this may be due to the genotype make up or the differences in their genetical constitution. Similar findings were reported by Migawer, Ekram and Soliman, Mona (2001), Akbari *et al.* (2003), Söğüt *et al.* (2003), Abd-Alla, Maha (2004), Ahmed and Rahim (2007), Caliskon *et al.* (2008), Mohamed (2009) and Osman & Abdel-Motagally (2009) who concluded that varieties differences between the three genotypes of peanut in most studied traits. N.A.623 genotype surpassed in the highest values of plant height, pods yield/plant, 100-seed weight and pods yield/fed.

So for, data in Table 1 declared that the phosphorus application by the rate of 31 kg P₂O₅/fed. (P₃) gave the tallest plant in the 1st season and the maximum values for the all studied traits in both seasons, while the minimum values for the studied traits were recorded with 15.5 kg P₂O₅/fed.

(P₁) in both seasons, except the 100-seeds weight and pods weight/plant in the 1st and 2nd seasons, respectively. The results supported that the highest phosphorus application increased pods yield/fed. and its attributes as compared to the minimum one. The increase in dry pod yield may be due to the ability of plant to accumulate more food material within seed at the maximum phosphorus level. These results may be ascribed to the fact that phosphorus may be encourage the metabolic processes (Nasr-alla *et al.*, 1998). The number of field pods/plant significantly increased with P at 40 and 80 kg P₂O₅/ha (Rekha and Reddy, 2002).

These results are in agreement with those reported by Akbari *et al.* (2003), Baktash *et al.* (2004), Maity *et al.* (2004), Nguyen (2004), Osman & Abdel-Motagally (2009) and Shiyam (2010) who mentioned that the highest values of the studied traits were obtained at 40 kg P₂O₅/ha.

Concerning the N fertilizer, data in table 1 showed that the plant height and pod yield and its attributes increased with increasing nitrogen application. The tallest plant and the maximum values for the most studied traits were obtained from the highest nitrogen rate (35 kg N/fed.). Wen *et al.* (2002) reported that a highly effective N fertilizer application management program for crop production on the sandy soil is possible. Similar findings were stated by Basyouny *et al.* (2004), Saxena *et al.* (2004), Lanier *et al.* (2005) and Moraditochae (2012) who mentioned that seed yield, fodder yield and biological yield were increased with increase nitrogen application up to 75 kg N/ha.

Interactions Effect:

a- Varieties x Phosphorus fertilization interaction (VxP)

The data in Table (2) revealed that plant height, number of branches, yield attributes and pod yield affected significantly and highly significantly by the first order interaction between varieties with phosphorus fertilization (VxP) in the both growing seasons, except 100-seed weight and biological yield in the first and second seasons, respectively.

The tallest plants and the maximum number of branches/plant were recorded by V₂xP₃ in the first season and by V₁xP₁ in the second season. This means that the behaviour of the varieties affected by phosphorus application and environmental effect. As well as the number of branches/plant depend on the plant height in order to give the more branches.

V₃xP₃ and V₃xP₂ interactions gave the highest values for pods weight/plant in the 1st and 2nd season, respectively. As well as V₁xP₃ interaction gave the heaviest 100-seeds in the 2nd season.

V₁xP₁ or V₁xP₂ and V₂xP₂ interactions in the 1st season recorded the maximum pods yield/fed. As well as, the maximum values for pods and fodder yields/fed. were recorded by the V₃xP₃ and/or V₂xP₃ interaction in the 2nd and both seasons, respectively, and also the maximum value for the biological yield were obtained by the V₁xP₁ or V₁xP₃ interaction in the 1st season.

b- Varieties x Nitrogen fertilization interaction (VxN):

The data in Table (3) showed that all studied traits had a significantly or highly significantly affected by varieties with nitrogen fertilization

(VxN) interaction in both seasons, except 100-seeds weight in the 1st season, plant height and number of branches/plant in the 2nd season.

The tallest plant and the maximum number of branches/plant were obtained by V₁xN₃ and V₂xN₃ interactions in the first season, respectively. As well as, the maximum values for pods weight/plant, fodder yield (ton/fed.) and biological yield (ton/fed.) were recorded by V₃xN₃ interaction in both seasons, however the pods yield surpassed with V₁xN₃ or V₁xN₁ and V₃xN₅ interactions in the 1st and the 2nd seasons, respectively. This is logic, since the pods weight/plant realized with V₁xN₃ interaction in the first season. On the other hand, the V₁xN₂ or V₁xN₁ interaction gave the heaviest 100-seed in the 2nd season.

c- Phosphorus x Nitrogen fertilization interaction (PxN):

The data in Table (4) revealed that the all studied traits affected significantly or highly significantly by the phosphorus and nitrogen fertilization (PxN) interaction in the both seasons, except the plant height had non-significant in the 2nd season.

The tallest plant and the maximum number of branches/plant were realized either with P₃xN₃ interaction in the first season or with the both interactions P₃xN₂ and P₃xN₃ in the 2nd season for the number of branches/plant only. The heaviest 100-seed was stated at P₁xN₂ interaction in both seasons. As well as, the maximum values for the fodder yield/fed. and biological yield/fed. in both seasons or for the pods weight/plant in the 1st season only was realized with P₂xN₂, while P₂xN₃ interaction gave the maximum value for pods yield/fed. in the 1st season.

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تأثير التسميد النيتروجيني والفوسفاتي علي المحصول ومكوناته لبعض أصناف الفول السوداني في الأراضي الرملية الجيرية
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أجريت تجربتان حقليتان في أرض رملية جيرية بمزرعة تجارب الغريب - كلية الزراعة - جامعة أسيوط خلال موسمي 2009 و 2010 وذلك لبحث تأثير ثلاث معدلات من التسميد النيتروجيني (15 ، 25 ، 35 كجم ن/فدان) وثلاث معدلات من التسميد الفوسفاتي (15.5 ، 23 ، 31 كجم فو₂/5 فدان) علي المحصول ومكوناته لثلاثة أصناف من الفول السوداني : جيزه 9 (مفترش) وجيزه 5 (قائم) وجيزه 6 (قائم).

ويمكن تلخيص النتائج كما يلي:

- كانت أطول النباتات وأعلى قيم لوزن 100 بذرة ومحصول القرون/فدان للصنف جيزة 9 في الموسم الثاني والأول علي التوالي ، بينما كانت أعلى القيم لصفات وزن القرون/نبات ، ومحصول العرش والمحصول البيولوجي/فدان للصنف جيزة 6 في كلا الموسمين.
- زاد محصول القرون/فدان ومكوناته بإضافة أعلا معدلات التسميد الفوسفاتي (31 كجم فو₂/5 فدان) بالمقارنة بأقل المعدلات (15.5 كجم فو₂/5 فدان).
- حصل علي أطول النباتات وأعلى القيم للمحصول ومكوناته مع أعلى المعدلات التسميد النيتروجيني (35 كجم ن/فدان).
- عامة، أعطي تفاعل أعلى معدلات للتسميد الفوسفاتي والتسميد النيتروجيني ($P_3 \times N_3$) أطول النباتات وأعلى القيم عدد الفروع/نبات ، محصول العرش ، المحصول البيولوجي. كما أن الصفات السابقة تأثرت بالتفاعلات بين الأصناف جيزه 9 (V_1) وجيزه 6 (V_3) مع أعلى المعدلات لكل من التسميد الفوسفاتي والنيتروجيني $V_1 \times P_3$ أو $V_3 \times P_3$ و $V_1 \times N_3$ أو $V_3 \times N_3$ حيث أعطت أعلى القيم.