3

Response of *Arachis hypogaea* L. to Different Levels of Phosphorus and Boron in Dry Environment

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$\mathbf{S}$OILS in arid and semi-arid regions, such Egypt, have low fertility. To improve the soil fertility and performance of crops, there is an urgent need to manage agricultural process such as plant nutrition is needed for such environments. To discuss the performance of yield under this conditions, two field trials were conducted using four phosphorus fertilizer levels (P_1 30, P_2 45, P_3 60 and P_4 75kg P_2O_5/fad) and three foliar spray with boron levels (B_0 tap water, B_1 100ppm and B_2 150ppm) on peanut. Results indicated that yield components, yield and its quality of peanut were positively ($P \leq 0.01$) affected by the two factors individually, also had positively ($P \leq 0.05$) affected by the various interactions on pod yield. The best pod yield was obtained by the bilateral interaction application of $P_4 \times B_2$. Correlation analysis appeared appearance of highly significant with r values between oil and pod yields.

Keywords: Arid regions, Peanut, Oil yield, Correlation analysis.

Introduction

Peanut (*Arachis hypogaea* L.) is one of self-pollinating most essential among edible oil seed crops throughout the world. The peanut is an important food and oilseed crop. It is called as the king of oilseeds crops (Hammons, 1982). Peanut ranks the 13th among food crops, 4th among source of the oil seed crops and the 3th among source of vegetable protein crops (Taru et al., 2008).

It is worth to note that, Egypt is suffering from dramatically shortage in edible oils, needed for nutritional consumption. Although in Egypt, the local production from crop oils is about 340 thousand tons in 2015, the Egyptian consumption is about 2.7 million tons in the same season.This indicated that, there is a major gap (87.4%) between local production and consumption, which has created importation to fulfill the requirements of market (FAO, 2016).

The yield potential of peanut crop is genetically determined and depends on limiting factors, such as soil and climatic conditions. The fertilization and pests or diseases are among the factors affecting directly the productivity of peanut crop.

Phosphorus is the 2th essential element that increases peanuts production, good quality and enhances water use efficiency. Phosphorus requirement for legumes crops are higher compared with another crops. Due to the essential role of

phosphorus element played in the physiological processes for plants, application of phosphorus element to soil deficient in the nutrient leads to increasing peanuts productivity. Phosphorus deficiency is known to reduce flower production, size of pods and adversely affect the formation of root nodules (Panwar et al., 2006). In this respect, Kabir et al. (2013), Kumar (2017) and Zoz et al. (2018) indicated that, increasing the level of phosphorus application increased pod and seed yield and all their attributes of peanut.

Peanut requires the seven micronutrients known to be essential for plants: Boron, chlorine, Copper, Iron, manganese, molybdenum and zincaccording to Murata (2003) in sandy soils of Zimbabwe. Boron element plays major role in the process of physiological of crops, like, regulated metabolism of carbohydrate, contribute in synthesis of protein (B.A.R.C., 2005) and help seed formationin peanut (Naiknware et al., 2015). Boron had essential role in saving flowering and fruit regulation in legumes (Zhang, 2001) and in peanut crop (Singh et al., 2009). Furthermore, it had a positive role on improved the pollination in peanut (Kaisher et al., 2010). This is why the using of boron element in the agricultural practices is increasing slowly. The need for boron element using in peanut is, therefore, to increase the yield.In this respect, recently, boron increase number of branches and pods, pod and seed weight, pods, seeds and oil yield in peanuts. These results were collaborated with Kabir et al. (2013). Naiknware et al. (2015), Quamruzzaman et al.

(2016), Chirwa et al. (2017), Hirpara et al. (2017) and Hirpara et al. (2018).

So, the objective of this investigation is to study the effect of different levels of phosphorus on soil fertilization and foliar spray with boron application on yield and quality of peanut cultivation under dry region conditions (Egypt) over two seasons.

Materials and Methods

During the two successive summer seasons 2017 and 2018, two field experiments were conducted on the Experimental Farm, Faculty of Agriculture, Fayoum University, Egypt. The experimental soil (Southeast Fayoum; 29°17'N, 30°53'E) was sandy loam with organic matter of 0.74%, electrical conductivity of 4.36dS/m and pH of 7.24, to study the effect of phosphorus soil fertilizer levels and foliar spray with boron levels application on yield and its components and quality of peanuts (*Arachis hypogaea* L.). The experimental unit area was 10.5m^2 consisting of five ridges, 3.5m long and 60cm apart. Peanut seeds were sown on April 8th and 15th in the first and second seasons, respectively. Peanut variety Giza 6 *cv.* was inoculated just before sowing with the specific rhizobium bacteria inoculants. The recommended agricultural practices for growing peanut were followed except the factors under study which arranged in split-plot in RCBD design with three replicates. Phosphorus soil fertilizer levels, as Calcium superphosphate (15.5% P$_2$O$_5$) was added during the seed bed preparation at four levels of 30 (P$_1$), 45 (P$_2$), 60 (P$_3$) and 75 (P$_4$) kg P$_2$O$_5$\fad were arranged in the main treatments. While, three foliar spray with boron levels in the form of boric acid, *i.e.,* 0 (B$_0$), 100 (B$_1$), and 150 (B$_2$) ppm were applied as foliar spray in two sprays at vegetative stage (30 and 50 days after sowing) and randomly distributed in sub treatments. Boric acid (Sigma-Aldrich Company, Germany) were applied, by 0.1% (v/v) Tween-20 as surfactant. The foliar solutions volume was 200L/fad conducted by hand sprayer. Nitrogen was added as ammonium sulfate (20.6 %N) at 30kg N fad^{-1} rate in three equal doses at 15, 30 and 45 days after sowing. Potassium fertilizer as potassium sulfate, 48% K$_2$O at 24kg k$_2$O fad^{-1} rate and organic fertilizer at 20m^3 fad^{-1} rate were incorporated into the soil surface during seed bed preparation. Surface irrigation was adopted as recommended. The preceding winter crops were faba bean and sugar beet in the first and the second seasons, respectively.

Peanut was manually harvested on September 9th

and 11th in the first and second seasons, respectively. At harvest, a random sample of ten plants were taken from each sub plot to determine number of branches plant^{-1}, number of pods plant^{-1}, weight of pods plant^{-1}, number of seeds plant^{-1} and weight of seeds plant^{-1}. Plants on the middle two rows in each sub plot were harvested and dried to calculate, pods and seed yield fad^{-1}. Samples, each of 50g seeds, were grinded into fine powder and stored in brown glass bottles for chemical analysis. Seed oil and N %, were determined according to the methods described by A.O.A.C. (1990), and the seed protein % was calculated by multiplying total nitrogen % by 6.25. Seed oil and protein yields per faddan were calculated by multiplying seed oil and N% by seed yield fad^{-1}.

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the spilt- plot design as outlined by Gomez & Gomez (1984), using MSTAT- C (Michogen, USA). Least Significant Difference (LSD, at 5% and 1% levels of probability) was used to test the differences between treatments means.

Results and Discussion

Effect of phosphorus soil fertilization levels application

Data in Tables 1, 2 and 3 illustrated that increasing phosphorus soil levels fertilizer from 30 to 75kg P fad^{-1} highly significantly increased (P≤ 0.01) on all traits of peanut crop over two seasons. The maximum superior treatments were the phosphorus at 75kg P$_2$O$_5$ fad^{-1}. Increasing phosphorus level to 75kg P$_2$O$_5$ fad^{-1} resulted in gradual increase in growth traits such as, number of branches plant^{-1}, number of pods plant^{-1}, weight of pods plant^{-1} (g), number of seeds plant^{-1} and weight of seeds plant^{-1} (g) amounted to (45.74 and 47.63%), (43.92 and 46.43%), (53.20 and 52.51%), (43.61 and 43.05%) and (57.23 and 58.01%), respectively. Concerning, phosphorus at the highest level 75kg P$_2$O$_5$ fad^{-1} effect exhibited similar trends in yield and quality traits such as, seed yield (ton fad^{-1}), pod yield (ton fad^{-1}), oil yield (kg fad^{-1}) and protein yield (kg fad^{-1}) amounted to (89.36 and 95.45%), (28.13 and 31.67 %), (102.89 and 109.64%) and (117.70 and 121.00%), respectively. Furthermore phosphorus at the same level 75kg P$_2$O$_5$ fad^{-1} in quality traits, such as seed oil %, nitrogen % and protein % amounted to (6.78 and 7.28%), (14.78 and 12.82%) and (14.59 and 13.05 %), respectively, comparing with 30kg P$_2$O$_5$ fad^{-1} level. The raise in peanut productivity

due to phosphoric fertilization may be refer to the activation of processes of metabolic, where its function in building nucleic acid and phospholipids (Marschner, 1986). Increases in the previous traits with increasing phosphorus levels may be due to that phosphoric fertilization is known to help improving a wider root system and thus helping plants to extract nutrient elements and water from different depth. This, in turn, could improve the performance of plants which were reflected in crop production. Many investigators confirmed such respond to phosphorus. Kabir et al. (2013) and recently, Kumar (2017) and Zoz et al. (2018) indicated that, increasing the level of phosphoric fertilization leads to an increased number of pods and seeds, weight of pods and seeds and yield in terms of pod, seed and oil of peanut.

Effect of foliar spraying with boron concentrations

The data on peanut yield and yield component traits *viz.,* number of branches $plant^{-1}$, number and weight of pods $plant^{-1}$, number and weight of seeds $plant^{-1}$, as well as yield in terms of pod, seed, oil and protein fad^{-1}, furthermore, quality traits such as seed oil, nitrogen and seed protein % as influenced by foliar spray with boron application were presented in Tables 1, 2 and 3 over two seasons. Increasing foliar spray with boron application up to B_2 (150ppm) had significant (P≤ 0.01) positive effects on peanut yield, yield components and quality traits. The B_2 (150ppm) significantly exceeded the B_0 (control, tap water) in all formers traits. In the same order of previous traits foliar spraying with boron at 150 (B_2) ppm increased yield components traits *viz.,* number of branches $plant^{-1}$, number and weight of pods $plant^{-1}$, number and weight of seeds $plant^{-1}$ by 5.85 & 8.22, 7.01 & 7.24, 5.18 & 5.09, 7.03 & 7.27 and 9.65 & 9.22%, respectively, while yield traits *viz.,* pod, seed, oil and protein fad^{-1} by 11.45 & 9.70, 17.19 & 17.74, 18.58 & 19.49 and 20.17 & 21.01, also increased quality traits such as seed oil, nitrogen and seed protein % by 1.49 & 1.55, 3.01 & 2.71 and 2.88 & 2.91%, in the 1st and 2nd season, respectively compared with B_0 (control treatment). The positive effect of increasing foliar spray of boron application on number of pods and seed of peanut may be due to its role in cell elongation and saving flowering and fruit regulation (Zhang, 2001 and Singh et al., 2009), furthermore it had a positive role on improved the pollination (Kaisher et al., 2010). Boron increase number of branches and pods, pods and seed weight, pod, seed and oil yield in peanuts, similar findings also were recorded by Helmy & Shaban (2008), Kabir et al.

(2013), Helmy & Ramadan (2014), Naiknware et al. (2015), Quamruzzaman et al. (2016), Chirwa et al. (2017), Hirpara et al. (2017) and Quamruzzaman et al. (2018). Furthermore, concerning the positive effect of boron application onsugar beet (Mekdad, 2015 a and Mekdad & EL-Sherif, 2016) and Mekdad & Rady (2016) reported that increasing foliar spray with boron increased significantly the productivity of sugar beet, while Mekdad (2015 b) illustrated that increasing foliar spraying with micronutrients mixture levels (Fe, Mn, Zn, Cu, B and Mo) increased significantly the productivity of sesame crop. The assessed Zn foliar application rates, up to $1.00g\ L^{-1}$ resulted in gradual increased most measured characteristics namely, seed, straw and pod yields, number of pods $plant^{-1}$, weight of pods $plant^{-1}$, number of seeds $plant^{-1}$, weight of seeds $plant^{-1}$, weight of 100 pods and weight of 100 seed, seed oil yield, N%, protein %, and protein yield of groundnut in 1st and 2nd seasons (Mekdad, 2017).

Interactions effect between phosphorus and boron levels

Data in Table 4 illustrated that number of pods $plant^{-1}$ (31.37) and pods yield ton fad^{-1} (1.71) in the first season, while quality traits in terms of seed oil (49.80%), nitrogen (4.06%) and protein (25.38 %) in the second one were significantly (P≤ 0.05) affected by the interaction application of soil phosphorus and foliar spray with boron levels. Application of P_4 (75kg P_2O_5 fad^{-1}) with B_2 level (150ppm) increased significantly the previous of studied traits. Chirwa et al. (2017), reported that the interaction between soil phosphorus and foliar spray with boron levels application increased significantly pod yield.

Yield analysis study
    Correlation coefficient
    The correlation coefficients showed in Table 5 between oil yield ton fad^{-1} and each of number of branches, pod and seed $plant^{-1}$ as well as weight of pod and seed $plant^{-1}$ g, furthermore pod and seed yield ton fad^{-1} and oil % were computed, in order to shed light on the relationship of effectual traits interest. Positive effect and significantly (P≤ 0.01) correlations were acquired between oil yield ton fad^{-1} and each of seed yield ton fad^{-1} r= 0.998** over two season, as well as number of pod $plant^{-1}$ r= 0.945** and 0.937** in both seasons, respectively. The results obtained in Table 6 showed that there are three traits, *i.e.* seed yield, oil (%) and number of pod in 2017 season and two traits, *i.e.* seed yield and oil (%) in 2018 season were a highly significant contributed to variation in oil yield.

TABLE 1. Effect of phosphorus and foliar spray with boron application levels on peanut yield attributes in 2017 and 2018 seasons (mean ± S. E.).

Treatments	Number of branches plant⁻¹		Number of pods plant⁻¹		Weight of pods plant⁻¹ (g)		Number of seeds plant⁻¹		Weight of seeds plant⁻¹ (g)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Phosphorus levels (P)										
30kg P fad⁻¹ (P₁)	11.15±0.39	11.17±0.45	21.47±1.01	21.04±0.94	30.96±2.02	31.29±2.34	40.47±2.33	40.79±2.61	20.62±1.64	20.67±0.46
45kg P fad⁻¹ (P₂)	12.93±0.67	12.93±0.64	24.83±1.14	23.96±1.06	37.45±2.68	37.85±2.91	46.25±3.22	46.50±3.06	25.13±1.71	24.82±0.61
60kg P fad⁻¹ (P₃)	14.65±0.90	14.70±0.94	28.53±0.92	27.78±1.11	44.13±1.68	44.71±1.35	52.74±2.47	53.19±2.41	28.90±2.01	29.39±0.78
75kg P fad⁻¹ (P₄)	16.25±0.42	16.49±0.37	30.90±1.12	30.81±1.35	47.43±1.42	47.72±1.37	58.12±1.92	58.35±2.09	32.42±1.37	32.66±0.45
LSD 0.05	0.69**	0.66**	0.87**	0.86**	2.23**	2.67**	1.65**	1.38**	1.38**	0.06**
Boron levels (B)										
Control (B₀)	13.33±2.05	13.26±2.17	25.55±3.98	25.00±3.95	38.96±	39.33±6.99	47.79±	47.99±7.30	25.59±	25.70±1.40
Boron 100ppm (B₁)	13.79±2.05	13.85±2.11	26.41±3.83	25.89±3.96	40.04±	40.52±6.73	49.23±	49.66±7.25	26.66±	26.89±1.47
Boron 150ppm (B₂)	14.11±2.08	14.35±2.05	27.34±3.62	26.81±3.95	40.98±	41.33±6.97	51.15±	51.48±7.15	28.06±	28.07±1.41
LSD 0.05	0.23**	0.25**	0.26**	0.39**	1.08**	1.12**	0.59**	0.91**	0.42**	0.57**
Interaction	N.S	N.S	0.52*	N.S	N.S	N.S	N.S	N.S	N.S	N.S
CVᵃ	1.92	2.06	1.13	1.74	3.11	3.20	1.37	2.11	1.79	2.45

*P< 0.05; **P< 0.01 and N.S= non-significant, ᵃCoefficient of variability.

TABLE 2. Effect of phosphorus and foliar spray with boron application levels on peanut yield in 2017 and 2018 seasons (mean ± S. E.).

Treatments	Seed yield (ton fad⁻¹)		Pod yield (ton fad⁻¹)		Oil yield (kg fad⁻¹)		Protein yield (kg fad⁻¹)	
	2017	2018	2017	2018	2017	2018	2017	2018
Phosphorus levels (P)								
30kg P fad⁻¹ (P₁)	0.47±0.05	0.44±0.07	1.28±0.10	1.20±0.09	215.89±23.51	202.71±31.01	162.15±18.69	155.16±24.07
45kg P fad⁻¹ (P₂)	0.65±0.08	0.63±0.06	1.44±0.08	1.36±0.07	304.19±37.56	295.85±30.29	234.28±29.27	230.36±23.87
60kg P fad⁻¹ (P₃)	0.76±0.05	0.74±0.07	1.57±0.05	1.50±0.05	361.42±27.77	354.66±34.53	288.12±23.30	283.48±29.68
75kg P fad⁻¹ (P₄)	0.89±0.05	0.86±0.05	1.64±0.07	1.58±0.07	438.02±29.79	424.96±27.48	353.00±27.60	342.84±25.01
LSD 0.05	0.08**	0.06**	0.05**	0.06**	37.75**	30.78**	28.12**	27.03**
Boron levels (B)								
Control (B₀)	0.64±0.16	0.62±0.17	1.40±0.16	1.34±0.16	303.54±82.48	293.07±86.40	237.37±70.55	230.77±72.57
Boron 100ppm (B₁)	0.68±0.17	0.66±0.17	1.48±0.16	1.41±0.17	326.14±87.02	315.37±88.54	255.54±73.82	248.86±73.74
Boron 150ppm (B₂)	0.75±0.17	0.73±0.16	1.56±0.13	1.47±0.15	359.95±89.74	350.20±86.02	285.25±78.88	279.26±74.39
LSD 0.05	0.02**	0.03**	0.03**	0.03**	8.74**	12.72**	7.89**	9.79**
Interaction	N.S	N.S	0.06*	N.S	N.S	N.S	N.S	N.S
CVᵃ	3.20	4.60	2.23	2.66	3.06	4.60	3.52	4.47

*P< 0.05; **P< 0.01 and N.S= non-significant, ᵃCoefficient of variability.

TABLE 3. Effect of phosphorus and foliar spry with boron application levels on peanut quality in 2017 and 2018 seasons (mean ± S. E.).

Treatments	Seed oil (%)		N %		Seed protein%	
	2017	2018	2017	2018	2017	2018
Phosphorus levels (P)						
30 kg P fad⁻¹ (P₁)	46.02±0.34	45.81±0.52	3.45±0.05	3.51±0.05	21.59±0.30	21.91±0.29
45 kg P fad⁻¹ (P₂)	46.86±0.30	46.79±0.29	3.61±0.07	3.64±0.07	22.56±0.41	22.77±0.43
60 kg P fad⁻¹ (P₃)	47.82±0.40	47.85±0.47	3.81±0.05	3.82±0.07	23.82±0.34	23.89±0.42
75 kg P fad⁻¹ (P₄)	49.14±0.77	49.15±0.82	3.96±0.08	3.96±0.06	24.74±0.49	24.77±0.56
LSD 0.05	0.80**	0.74**	0.03**	0.05**	0.21**	0.34**
Boron levels (B)						
Control (B₀)	47.11±1.20	47.05±1.31	3.66±0.20	3.69±0.18	22.88±1.24	23.03±1.12
Boron 100 ppm (B₁)	47.46±1.30	47.38±1.35	3.70±0.20	3.72±0.18	23.11±1.25	23.27±1.09
Boron 150 ppm (B₂)	47.81±1.30	47.78±1.45	3.77±0.22	3.79±0.21	23.54±1.35	23.70±1.31
LSD 0.05	0.19**	0.23**	0.03**	0.03**	0.16**	0.17**
Interaction	N.S	0.47*	N.S	0.05*	N.S	0.33*
CVᵃ	0.46	0.58	0.81	0.82	0.81	0.82

*P < 0.05; **P < 0.01 and ns – non-significant, ᵃ Coefficient of variability

TABLE 4. Effect of the interaction between phosphorus and foliar spray with boron application levels on yield, yield attributes and quality of peanut in 2017 and 2018 seasons.

P levels (kg fad⁻¹)	Foliar B (ppm)	Number of pod plant⁻¹		Pod yield (ton fad⁻¹)		Oil (%)		N (%)		Protein (%)	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
30 (P₁)	Zero (B₀)	20.48	20.19	1.18	1.13	45.67	45.39	3.42	3.46	21.35	21.65
	100 (B₁)	21.35	20.96	1.27	1.18	45.98	45.79	3.44	3.51	21.52	21.94
	150 (B₂)	22.58	21.96	1.36	1.27	46.41	46.26	3.50	3.54	21.90	22.15
45 (P₂)	Zero (B₀)	23.76	23.06	1.39	1.28	46.65	46.68	3.56	3.60	22.23	22.52
	100 (B₁)	24.88	24.06	1.43	1.37	46.83	46.73	3.61	3.63	22.54	22.71
	150 (B₂)	25.84	24.76	1.52	1.42	47.11	46.95	3.66	3.69	22.90	23.08
60 (P₃)	Zero (B₀)	27.56	26.69	1.52	1.45	47.50	47.57	3.77	3.77	23.58	23.58
	100 (B₁)	28.47	27.69	1.56	1.49	47.82	47.89	3.81	3.82	23.79	23.88
	150 (B₂)	29.57	28.95	1.58	1.51	48.14	48.08	3.85	3.87	24.08	24.21
75 (P₄)	Zero (B₀)	30.40	30.05	1.60	1.55	48.63	48.55	3.90	3.90	24.35	24.38
	100 (B₁)	30.93	30.83	1.65	1.59	49.21	49.09	3.93	3.93	24.58	24.56
	150 (B₂)	31.37	31.54	1.71	1.65	49.57	49.80	4.04	4.06	25.27	25.38
LSD 0.05		0.52*	N.S	0.06*	N.S	N.S	0.47*	N.S	0.05*	N.S	0.33*

* P< 0.05; **P< 0.01 and N.S; non-significant

TABLE 5. A matrix of simple correlation coefficient between oil yield and other important traits estimated in 2017 and 2018 season.

Character	Number of branch plant⁻¹		Number of pods plant⁻¹ (g)		Weight of pods plant⁻¹ (g)		Number of seeds plant⁻¹ (g)		Weight of seeds plant⁻¹ (g)		Pod yield (ton fad⁻¹)		Seed yield (ton fad⁻¹)		Oil (%)		Oil yield (kg fad⁻¹)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Number of branch plant⁻¹	1	1	0.957**	0.965**	0.960**	0.943**	0.966**	0.968**	0.978**	0.974**	0.893**	0.937**	0.939**	0.960**	0.907**	0.917**	0.943**	0.968**
Number of pod plant⁻¹			1	1	0.967**	0.955**	0.973**	0.967**	0.971**	0.959**	0.942**	0.928**	0.940**	0.922**	0.924**	0.947**	0.945**	0.937**
Weight of pod plant⁻¹ (g)					1	1	0.968**	0.957**	0.966**	0.958**	0.911**	0.906**	0.903**	0.901**	0.898**	0.893**	0.908**	0.910**
Number of Seed plant⁻¹							1	1	0.984**	0.974**	0.912**	0.919**	0.901**	0.914**	0.905**	0.902**	0.909**	0.924**
Weight of Seed plant⁻¹ (g)									1	1	0.921**	0.929**	0.928**	0.938**	0.916**	0.906**	0.934**	0.947**
Pod yield (ton fad⁻¹)											1	1	0.935**	0.954**	0.883**	0.873**	0.935**	0.956**
Seed yield (ton fad⁻¹)													1	1	0.917**	0.879**	0.998**	0.998**
Oil (%)															1	1	0.936**	0.906**
Oil yield (kg fed⁻¹)																	1	1

** Correlation coefficient is significant at P≤ 0.01

TABLE 6. Correlation coefficient (r), coefficient of determination (R²) and standard error of the estimates (SEE) for predicting oil yield in 2017 and 2018 seasons.

Season	R	R²	SEE	Sig.	Fitted equation
2017	1.00	1.00	1.61	**	Oil yield (ton fad⁻¹)= -436.74 + 465.69 seed yield + 9.64 oil -0.49 number of pods plant⁻¹
2018	1.00	1.00	1.99	***	Oil yield (ton fad⁻¹)= -372.06 + 462.82 seed yield + 8.05 oil

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إستجابة الفول السودانى لمستويات السماد الفوسفورى والرش الورقى بالبورن تحت ظروف البيئة الجافة

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تم تنفيذ تجربتان حقليتان في مزرعة كلية الزراعة بالفيوم بمنطفة دمو– جامعة الفيوم - مصر. خلال الموسم الصيفى لعامى 2017 و2018 لدراسة تأثير مستويات السماد التسميد الفوسفورى والرش الورقى بالبورون و التفاعل بينهماعلى المحصول ومكوناتة للفول السودانى صنف جيزة 6. تم إستخدام القطع المنشقة مرة واحدة فى تصميم القطاعات كاملة العشوائية ذى ثلاثة مكررات فى الموسمين. حيث تضمنت معاملة التسميد الفوسفورى (30، 45، 60 و75 كجم فدان⁻¹) القطع الرئيسية بينما وزعت معدلات للرش الورقى بعنصر البورن (0، 100 و150جزئ في المليون) فى القطع الشقية. يمكن ايجاز اهم النتائج المتحصل عليها فيما يلي:(1) أدت زيادة السماد الفوسفورى والرش الورقي بالبورن إلى زيادة عالية المعنوية في صفات المحصول مثل (وزن محصول البذور، وزن محصول الثمار، وزن محصول الزيت و وزن محصول البروتين الفدان⁻¹) و مكوناتة (عدد الفروع/النبات، عدد الثمار/النبات، وزن الثمار/النبات، عدد البذور/النبات، وزن البذور/النبات) و كذلك صفات الجودة (نسبة الزيت بالبذور %، نسبة النيتروجين بالبذرة %، نسبة البروتين بالبذور%) وذلك في موسمى الدراسة.(2) تشير النتائج إلى أن أعلى محصول من الثمار والبذور والزيت للفدان قد نتج من استخدام المعدل الأعلى من التسميد الفوسفورى (75 كجم فدان⁻¹) بالمقارنة بإستخدام المستوى الأقل (30 كجم فدان⁻¹) خلال موسمى الدراسة.(3) اظهرت نتائج التفاعل بأنة تم الحصول على أعلى القيم لعدد الثمار للنبات ولمحصول الثمار للفدان من أستخدام المستوى الأعلى للتسميد الفوسفورى (75 كجم فدان⁻¹) مع إستخدام المعدل الأعلى من الرش الورقى بالبورن (150جزئ في المليون).(4) أظهرت النتائج المتحصل عليها وجود إرتباط إيجابى عالى المعنوية (r= 0.998) بين محصول الزيت و محصول البذور في كلا الموسمين.