J. Plant Production, Mansoura Univ., Vol. 8 (5): 605 - 609, 2017

Effect of Npk-Levels on Productivity and Seed Quality of Some Groundnut Genotypes under Newly Reclaimed Sandy Soils Conditions

Seadh, S. E.[1]; W. A. E. Abido[1]; A. N. Abd El-Al[2] and Z. A. A. Ibrahim[1]
[1] Agron. Dept., Fac. of Agric., Mansoura Univ., Egypt.
[2] Oil crops Dept., Field Crops Res. Inst., Agric. Res. Center

ABSTRACT

At the Station of Experimental Research in Ismailia, ARC, Egypt, in 2014 season a field experiment was conducted, and the same field experiment was replicate in 2015 seasons to find out the influence of NPK-rates on productivity and seed quality of some groundnut genotypes lower newly reclaimed sandy soils conditions in Ismailia Governorate. In design of strip-plot, the experiment was carried out using four replications. Results showed that Strain 13 among the studies genotypes had the highest values of plant height and crude protein percentage in seeds. While, Gregory cultivar recorded the highest values of oil percentage in seeds. However Strain 281 significantly surpassed other studied genotypes and recorded the highest means of other considered traits. In each seasons, plants of groundnut were mineral fertilizing by 45.0 + 30.0 + 24.0 kg NPK per feddan, respectively (100 % of the recommended doses) surpassed other studied NPK-levels under study and produced the highest means of every one of considered means, followed by using 80 % and then 60 % of the recommended doses. It could be recommended that mineral fertilizing groundnut Strain 281 or Strain 10 or Gregory cultivar with 45.0 kg N + 30.0 kg P_2O_5 + 24.0 K_2O per feddan to recorded highest productivity under newly reclaimed sandy soils conditions in Ismailia Governorate.

Keywords: Ground nut, pea nut, cultivars, varieties, genotypes, NPK-levels, yield, seed quality.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important crop among oilseeds. The importance of groundnut otherwise called peanut is due to the high nutritive value of its seeds which considered rich source of edible oil (43-55%), protein (25-28%), vitamin B and C, in addition to other vital components. Moreover, the peanut green leafy organs (contain more than 10% protein) is another advantage characterized the crop as a good fodder for livestock. In addition, the crop has a good ability for growing in lightly soil, and thrives in improving the characteristics of the newly reclaimed sandy soils which commonly suffer from some constraints such as poor physical properties and nutrients deficiency.

Vertical expansion and maximum productivity can be achieved for any crop through the use of appropriate agricultural practices. In addition, the clear role of agricultural processes, such as the use of promising genetic patterns as well as levels of fertilization, have a very deterministic effect on growth, yield, properties and chemical components of groundnut yield

The selection of high-yielding genotypes from any undisputed crop is very important for raising their productivity per unit area. To this end, this study aims to assess new promising genetic patterns with older traditional varieties in order to highlights the suitable genotypes can be cultivated under newly reclaimed sandy soils conditions. Akhtar *et al.* (2013) showed that the genotypes ranked best on the basis of morpho-physiological parameters will be helpful for making recommendations to groundnut farmers. Borkar and Dharanguttikar (2014) found that the highest pod yield was recorded by the genotypes ICG-8420, ICG-8473 and ICG-8506 due to significant favourable yield contributing characters like; number of pods/plant, pod and seed yields/plant. El-Saady *et al.* (2014) showed that superiority of plant height, pods yield and yield components and shelling percentage were recorded by Giza 6 and R 92 cultivars. Gaikpa *et al.* (2015) and Ahmed *et al.* (2016) reported that significant varietal differences were observed in groundnut pod yield, hundred seed weight, number of pods/plant and seed yield.

N, P and K are essential nutrients and an important determinant of plant growth and development. The addition of nitrogen fertilizer generally increases the proportion of shoot root and peanut root extract. On the other hand, phosphorus is an important food component for all crops in general and legumes in particular. It is an essential component of ATP and plays an important role in energy shifts in plants and also in different roles in seed formation (Sanker *et al.,* 1984). Application of phosphorus increases the yield of peanut and obtains input characters. In addition, K has a beneficial effect on N fixation and the transformation of photosensitites from leaves to root nodules (Savani *et al.,* 1995). Impartial fertilization of essential plant nutrients, especially N, P and K in optimal quantity through the appropriate timely method in the appropriate proportion has always led to improved yields. Veeramani and Subrahmaniyan (2012) revealed that the use of 175% of the recommended dose of fertilizer (30: 60: 95 kg NPK/ha) recorded high levels of growth, yield parameters, yield and economic returns of peanuts. Shiva-Kumar *et al.* (2014) showed that the treatment receiving NPK fertilizers level of 30 kg N + 60 kg P_2O_5 + 25 kg K_2O per hectare considerably produced higher pods number per plant, weight of hundred seeds and seed yield (2441 kg/ha). Beremjungl and Gohain (2016) revealed that among the different fertilizer doses, application of NPK at 100% to groundnut (20 : 60 : 40 kg NPK per hectare) was the best fertilizer dose producing the highest growth and yield.

Thus, this study was conducted to find out the impact of NPK - levels on productivity and quality of some groundnut genotypes under newly reclaimed soil conditions in Ismailia Governorate, in North East of Egypt.

MATERIALS AND METHODS

Field experiment was conducted at the Station of Experimental Research in Ismailia, ARC, Egypt, in 2014 seasons and the same field experiment was replicate in 2015 seasons to revision the influence of NPK-rates on productivity and seed quality of some groundnut genotypes lower newly reclaimed sandy soils conditions in Ismailia Governorate.

Design of strip-plot was used in with four replications. Where, groundnut genotypes were allocated in vertical plots as follows:

1- Strain 10. Local genotype.
2- Strain 8. Local genotype.
3- Strain 13. Local genotype.
4- Strain 6. Local genotype.
5- Strain 7. Local genotype.
6- Strain 281. Local genotype.
7- Giza 6. Local cultivar.
8- Gregory. American cultivar.

NPK rates were billed in horizontal plots as follows:

1- 45.0 + 30.0 + 24.0 kg NPK per feddan.
2- 36.0 + 24.0 + 19.2 kg NPK per feddan.
3- 27.0 + 18.0 + 14.4 kg NPK per feddan.

Calcium superphosphate, which contains 15.5% P_2O_5 was added through soil preparation at the above rates. Ammonium nitrate, which contains 33.5% of N was applied as formerly mentioned rates in 2 equivalent parts before the 1st and 2nd irrigations. Potassium sulphate, which contains 48% K_2O at the rates previously mentioned in single dose before the first irrigation. The experimental unit area was 10.5 m^2. The previous winter crop was Egyptian clover in every season.

Samples of soil were randomly taken as of experimental field prior to soil grounding to evaluate the soil properties as revealed in Table 1.

The experimental field was prepared through two plowing, leveling and then dividing into experimental units (10.5 m^2). Groundnut seeds were grown in 25 cm hills with 3 to 4 seeds / hill using dry seeding on one side of the hills during the last week of April in the every growing season. Additional agricultural practices have been maintained, as is usually the case in groundnut fields in harmony with the recommendations of the Ministry of Agriculture, excluding the factors in reading.

After 130 days of cultivation random samples of 5 guarded plants were taken from each piece to establish the next characters:

1- Height of plant (cm).

Marketable pods per plant were picked and let to dry up normally, then, the following characters were determined:

2- Number of pods/plant.
3- Pods weight/plant (g).

Samples of twenty dry pods were taken to determine the following characters:

4- Pod weight (g).
5- Number of seeds/plant.
6- Seeds weight/plant (g).
7- 100 – seed weight (g).
8- Seed yield (ardab/fed). Whole plants in each plot were harvested and left to dry on air, then they were threshed and the seeds (which were at 13 % moisture) were weighted (kg), then converted to ardab per fed (one ardab = 75 kg).
9- Proportion of crude protein in seeds (%).
10. Percentage of oil (%).

Table 1. Soil characteristics of experimental sites during both seasons.

Soil properties		2014 Season	2015 Season
A: Mechanical analysis:			
Coarse sand (%)		74.60	73.95
Fine sand (%)		18.80	18.92
Clay (%)		4.65	5.20
Texture class		Sandy	Sandy
B: Chemical analysis:			
E.C. ds. M^{-1}		0.32	0.33
pH		7.86	7.95
O.M. (%)		0.42	0.43
$CaCO_3$ (%)		1.95	1.93
Available nutrients (ppm)	N	21.32	21.55
	P	4.85	4.92
	K	63.45	64.12
Exctrable DTPA (ppm)	Zn	0.42	0.41
	Fe	3.01	2.95
	Mn	0.61	0.65
Anions meq/100 g soil	CO_3^{--}	-	-
	HCO_3^-	0.63	0.61
	Cl^-	0.68	0.65
Cations meq/100 g soil	Ca^{++}	0.40	0.39
	Mg^{++}	0.30	0.31
	Na^+	0.78	0.75
	K^+	0.13	0.15

According to ANOV as described by Gomez and Gomez (1984), all recorded data were statistically analyzed. As mentioned by Snedecor and Cochran (1980), LSD method was used to compare the differences among treatments.

RESULTS AND DISCUSSION

1. Performance of genotypes:

Among the eight groundnut genotypes under study significant differences were detected in plant height, number of pods/plant, pods weight/plant, pod weight, number of seeds/plant, seeds weight/plant, 100-seed weight, seed yield/fed, crude protein and oil percentages in seeds in both seasons (Tables 2 and 3). Strain 13 among the studies genotypes had the tallest groundnut plants and the highest values of crude protein percentage in seeds in the two seasons. While, Strain 281 significantly surpassed other studied genotypes and recorded the highest values of number of pods/plant, pods weight/plant, pod weight, number of seeds/plant, seeds weight/plant, 100-seed weight and seed yield/fed in the two growing seasons. However, Gregory recorded the highest values of seed oil in both seasons. Previous results may be related to genetic factors formed by the varieties used. Similar results have been obtained by Borkar and Dharanguttikar (2014), El-Saady *et al.* (2014), Gaikpa *et al.* (2015) and Ahmed *et al.* (2016).

Table 2. Plant height, number of pods/plant, pods weight/plant, pod weight and number of seeds/plant as affected by groundnut genotypes, nitrogen, phosphorus and potassium fertilizers levels (NPK-levels) as well as their interaction during 2014 and 2015 seasons.

Characters	Plant height (cm)		Number of pods/plant		Pods weight/ plant (g)		Pod weight (g)		Number of seeds/plant	
Seasons / Treatments	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
A- Genotypes performance:										
Strain 10	27.26	27.52	29.51	32.50	57.31	66.63	1.946	1.851	50.85	54.18
Strain 8	29.63	37.03	19.66	18.87	33.02	37.63	1.748	1.970	28.54	32.91
Strain 13	35.36	42.72	22.00	28.45	37.76	51.57	1.811	1.804	48.34	48.34
Strain 6	27.94	31.55	23.20	29.57	42.57	50.81	1.830	1.675	51.98	51.98
Strain 7	22.71	35.61	21.80	32.47	38.76	51.90	1.823	1.602	56.13	56.13
Strain 281	29.78	30.00	32.07	39.68	64.45	71.55	1.979	2.066	59.65	59.65
Giza 6	30.82	31.60	20.21	24.10	39.39	37.98	1.941	1.574	43.43	43.43
Gregory	33.82	34.51	29.37	33.12	45.90	55.10	1.571	1.670	58.92	58.92
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.94	2.06	1.43	1.39	1.87	1.42	0.077	0.074	3.56	2.38
B- NPK-levels:										
45.0 kg N + 30.0 kg P_2O_5 + 24.0 K_2O/fed	30.21	34.91	30.30	36.07	55.10	64.57	1.889	1.862	59.71	61.35
36.0 kg N + 24.0 kg P_2O_5 + 19.2 K_2O/fed	29.68	34.42	24.81	30.27	45.51	55.54	1.815	1.810	52.18	52.18
27.0 kg N + 18.0 kg P_2O_5 + 14.4 K_2O/fed	29.10	32.11	19.07	23.20	34.07	38.57	1.789	1.658	37.30	38.55
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.55	0.43	1.72	1.82	1.12	0.63	0.096	0.102	2.60	1.97
C- Interaction (F. test):										
A × B	*	*	*	*	*	*	*	*	*	*

Table 3. Seeds weight/plant, 100 – seed weight, seed yield/fed, crude protein and oil percentages in seeds as affected by groundnut genotypes, nitrogen, phosphorus and potassium fertilizers levels (NPK-levels) as well as their interaction during 2014 and 2015 seasons.

Characters	Seeds weight/plant (g)		100 - seed weight (g)		Seed yield (ardab/fed)		Protein (%)		Oil (%)	
Seasons / Treatments	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
A- Genotypes performance:										
Strain 10	47.38	47.38	84.13	84.13	24.11	24.11	28.52	27.74	47.23	47.93
Strain 8	27.26	27.26	85.37	85.37	15.87	15.87	29.43	27.24	47.80	48.69
Strain 13	38.98	38.98	80.71	80.71	18.15	18.15	29.77	28.39	46.30	47.17
Strain 6	41.40	41.40	78.53	78.53	19.68	19.28	28.38	28.10	47.42	48.31
Strain 7	40.23	40.23	74.31	74.31	21.28	21.28	29.19	28.00	46.64	47.42
Strain 281	53.66	53.66	87.43	87.43	26.27	26.27	27.36	26.57	48.57	49.44
Giza 6	26.95	26.95	65.20	65.20	18.45	18.45	27.70	26.74	48.22	49.05
Gregory	42.31	42.31	73.36	73.36	23.37	23.37	27.01	26.27	48.99	49.95
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.32	1.31	1.93	1.92	1.03	0.86	0.35	0.26	0.21	0.22
B- NPK-levels:										
45.0 kg N + 30.0 kg P_2O_5 + 24.0 K_2O/fed	50.34	50.34	82.07	82.07	23.01	23.01	28.67	27.45	47.67	48.55
36.0 kg N + 24.0 kg P_2O_5 + 19.2 K_2O/fed	41.47	41.47	80.50	80.50	21.11	21.11	28.44	27.37	47.66	48.51
27.0 kg N + 18.0 kg P_2O_5 + 14.4 K_2O/fed	27.51	27.51	73.32	73.32	18.58	18.43	28.15	27.33	47.60	48.42
F. test	*	*	*	*	*	*	*	NS	NS	NS
LSD at 5 %			1.88	1.87	0.37	0.28	0.41	-	-	-
C- Interaction (F. test):										
A × B	*	*	*	*	*	*	NS	NS	NS	NS

2. NPK-levels effects:

The obtained results clarified that NPK-levels under study *i.e.* 100, 80 and 60 % of the recommended doses (45.0 + 30.0 + 24.0 kg NPK, respectively per fed, 36.0 + 24.0 + 19.2 kg NPK, respectively per fed and 27.0 + 18.0 + 14.4 kg NPK, respectively per fed) had a significant effects on plant height, number of pods/plant, pods weight/plant, pod weight, number of seeds/plant, seeds weight/plant, 100 – seed weight and seed yield/fed in both seasons and crude protein percentage in seeds in the first season only (Tables 2 and 3).

Fertilizing groundnut plants with 45.0 kg N + 30.0 kg P_2O_5 + 24.0 K_2O per fed excesses other studied NPK-levels under study and produced the highest means of each studied traits in the every season. This treatment followed by fertilizing groundnut plants with 80 % and then 60 % of the optional doses in both seasons. These results can be recognized to that NPK are considers as the most important nutrients for plant nutrition and enhancing vegetative growth, establishment and yields as well as seed quality. These findings are supported by Veeramani and Subrahmaniyan (2012), Shiva-Kumar *et al.* (2014) and Beremjungl and Gohain (2016).

3. Interaction effect:

On the effect of interaction, several significant effects were found by the interaction between groundnut genotypes and levels of NPK) on every studied traits (Tables 2 and 3). The author offers only a considerable interaction concerning seed yield.

Fertilized groundnut Strain 281 plants with 45.0 + 30.0 + 24.0 kg NPK per feddan lead to obtain highest means of seed yield/ha in every season (Fig. 1). The subsequent most effective treatment was the 10-point peanut mineral fertilization of 100% of the recommended doses, followed by the Gregorian grade pistachios by 100% of the recommended doses in both seasons

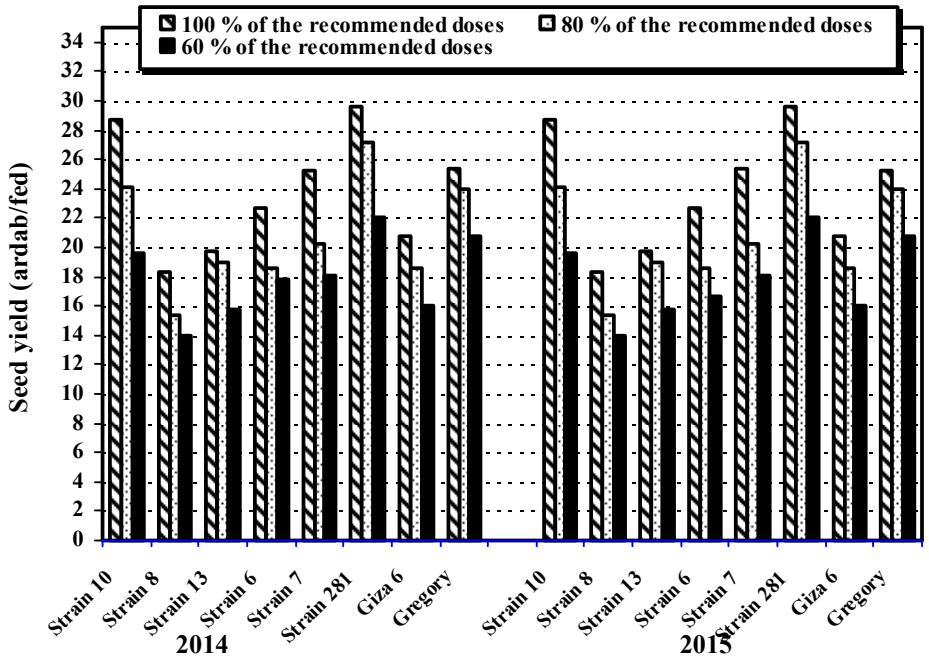

Fig. 1. Seed yield (ardab/fed) as affected by the interaction between groundnut genotypes and NPK-levels during 2014 and 2015 seasons.

REFERENCES

A.O.A.C. (2007). Official Methods of Analysis. 18th Ed. Association of Official Analytical Chemists, Inc., Gaithersburg, MD, Method 04.

Ahmed, Y.E.M. ; A.A.M. Osman ; M.A. Makeen and Tarig E. A. Suliman (2016). Effect of NPK micro doses fertilizer on leaf area, leaf area index and pods and hay yield of six genotypes of groundnut-North Kordofan State-Sudan. Intern. J. of Sci. & Tech. Res., 5(5): 59-63.

Akhtar, S. ; A. Shahzad ; M. Arshad and F. Ul-Hassan (2013). Morpho-physiological evaluation of groundnut (*Arachis hypogaea* L.) genotypes for iron deficiency tolerance. Pakistan J. Bot., 45(3): 893-899.

Beremjungl, A and T. Gohain (2016). Effect of different levels of NPK fertilizer management on maize + groundnut (2:2) intercropping system under rainfed condition. Intern. J. of Agric. Sci. and Res., 6(1): 155-160.

Borkar, V.H. and V.M. Dharanguttikar (2014). Evaluation of groundnut (*Arachis hypogaea* L.) genotypes for physiological traits. Intern. J. of Sci. and Res. Pub., 4(1): 1-8.

El-Saady, A.M. ; A.A. El-Sayed ; W.M.A.K. Teilep and M.F. El-Dahshouri (2014). Response of some peanut (*Arachis hypogaea* L.) cultivars grown in sandy soil to soil and foliar feeding with the different sources of phosphorus. Intern. J. of Plant & Soil Sci., 3(6): 523-537.

Gaikpa, D.S. ; R. Akromah ; J.Y. Asibuo ; Z. Appiah-Kubi and D. Nyadanu (2015). Evaluation of yield and yield components of groundnut genotypes under *Cercospora* leaf spots disease pressure. Intern. J. of Agron. and Agric. Res., 7(3): 66-75.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. 2nd Ed., Jhon Wiley and Sons Inc., New York, pp: 95-109.

Sanker, A.S. ; P.R. Reddy and I.V.S. Rao (1984). Nodulation and nitrogen fixation in groundnut as affected by seed size and phosphorus. Legume Res., 7: 1-5.

Savani, V.N. ; M.R. Vaioshnav ; P.R. Vaishnav and V.B. Darji (1995). Statistical estimation of relative changes in P content with different levels of applied phosphorus in groundnut. J. Gujarat Agric. Univ. 21: 119-123.

Shiva-Kumar, L. ; B.M. Radder, L.H. Malligawad and V. Manasa (2014). Effect of nitrogen and phosphorus levels and ratios on yield and nutrient uptake by groundnut in northern transition zone of Karnataka. The Bioscan, 9(4): 1561-1564.

Snedecor, G.W. and W.G. Cochran (1980). "Statistical Methods" 7th Ed. The Iowa State Univ. Press, Iowa, USA.

Veeramani, P. and K. Subrahmaniyan (2012). Physical and economic optimum of response model for NPK application in irrigated groundnut (*Arachis hypogaea* L.). Madras Agric. J., 99 (7-9): 526-529.

تأثير مستويات التسميد النيتروجينى والفوسفاتى والبوتاسى على إنتاجية وجودة بذور بعض التراكيب الوراثية للفول السودانى تحت ظروف الأراضي الرملية حديثة الإستصلاح

صالح السيد سعده[١] ، وليد أحمد حمدى المعداوى عبيدو[١] ، على ناصف عبد العال[٢] و زاهر عونى عبد الكريم إبراهيم[١]

[١] قسم المحاصيل ـ كلية الزراعة- جامعة المنصورة.

[٢] قسم بحوث المحاصيل الزيتية – معهد بحوث المحاصيل الحقلية ـ مركز البحوث الزراعية.

أجريت تجربتان حقليتان في محطة البحوث الزراعية بالإسماعيلية ، مركز البحوث الزراعية ، مصر خلال موسمي ٢٠١٤ و ٢٠١٥ لدراسة تأثير مستويات التسميد النيتروجيني والفوسفاتى والبوتاسى على النمو والمحصول ومكوناته وصفات جودة البذور لبعض التراكيب الوراثية للفول السودانى تحت ظروف الأراضي الرملية حديثة الإستصلاح في محافظة الإسماعيلية. أجريت التجارب في تصميم الشرائح المتعامدة في أربعة مكررات. حيث اشتملت الشرائح الرأسية على التراكيب الوراثية للفول السودانى ، بينما احتوت الشرائح الأفقية مستويات التسميد النيتروجينى والفوسفاتى والبوتاسى. أظهرت النتائج المتحصل عليها أن السلالة ١٣ من بين التراكيب الوراثية للفول السودانى أعطت أعلى القيم لصفات ارتفاع النبات ونسبة البروتين الخام في البذور. بينما سجل الصنف جريجوري أعلى القيم بالنسبة لصفة النسبة المئوية للزيت في البذور. أما السلالة ٢٨١ فقد تفوقت بشكل ملحوظ على التراكيب الوراثية الأخرى للفول السودانى حيث سجلت أعلى القيم لباقى الصفات المدروسة في كلا موسمى الدراسة. أدى التسميد المعدنى لنباتات الفول السودانى بـ ١٠٠٪ من الجرعات الموصى بها من السماد النيتروجينى والفوسفاتى والبوتاسى (٤٥.٠ كجم نيتروجين + ٣٠ كجم P_2O_5 + ٢٤ كجم K_2O / فدان) للحصول على أعلى القيم لجميع الصفات المدروسة، يليه استخدام ٨٠٪ ثم ٦٠٪ من الجرعات الموصى بها في كلا الموسمين. من النتائج المتحصل عليها من هذه الدراسة يمكن التوصية بالتسميد المعدنى لنباتات الفول السودانى سلالة ٢٨١ أو سلالة ١٠ أو الصنف جريجوري بـ ٤٥.٠ كجم نيتروجين + ٣٠ كجم P_2O_5 + ٢٤ كجم K_2O / فدان للحصول على أعلى إنتاجية تحت ظروف الأراضي الرملية حديثة الإستصلاح في محافظة الإسماعيلية.