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Effect of Applying Potassumage and Banana Ash Combination as Bio-Fertilizers on Productivity of the Egyptian Wheat

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Abstract: Two pot experiments and field experiment were carried out at Agric. Res. Station, Fac. Agric., Al-Azhar Univ. Nasr City and El-Aleg region, Kaliobia governorate, Egypt, during 2011/2012, 2012/2013 and 2013/2014 to investigate the influence of K fertilizer packages as bio fertilizer on the productivity of wheat varieties. The three studied K fertilizer packages treatments were Potassiumag (bio fertilizer), Banana ash 4%, Potassumage +Banana ach 4% and control (without K fertilizer), as well as three wheat varieties (Sakha-93. Masry-1 and Banisweif). Complete randomized design was applied for the pot experiments, whereas, split plot design was conducted for the experimental field. Results showed significant differences between the three tested wheat varieties such as number of spikes/plant, number of grains/ spike, 1000 grains weight, yields of grains, straw and biological/yield per plant or per Fadden, as well as harvest index, Sakha 93 variety significantly surpassed Masr-1 and Baniswif-6 varieties in straw yield characters, while Masr-1 variety exceeded sakha-93 and Baniswif- 6 in grain yield characters. Moreover, Baniswif-6 gave grains quality characters higher than Sakha-93 and Masr-1 varieties in cache season under pot and field experiments. As for K fertilizer treatments, results showed that, significant differences were observed between the four studied potassium fertilizers packages for all studied characters under pot and field experiment in both seasons, whereas K4 treatments gave the highest values of growth, yield and yield components as well as technological characters. Also K3 treatment ranked the second and produced the highest values of the previous traits in both seasons. It worthy to mentioned that the differences between K3 and K4 treatments did not reach to the significant level. The interaction effect between the tested varieties and the studied K fertilizer packages was significant in most characters under study. Finally, applying 50% of recommended mineral K fertilizers with bio fertilizers (potassiumag + banana ash) are suitable fertilization treatment for maximizing the productivity of wheat varieties Sakha-93, Masr-1 and Baniswif-6 in pot or field experiments

Keywords: potassiumag, banana ash, packages, gap, problem

i. INTRODUCTION

Wheat is one of the most important cereal crops in Egypt and all over the world used in human food and animal feed. Wheat provides 29% of the total calories for the peapod and 32.6% of the protein in the Egyptian* diet. The total cultivated area of wheat in Egypt reached 3.05 million Fadden with total production of 8.4 million ton with an average 2.75 ton/Fadden under Egyptian conditions. [6], increasing wheat production is considered as one of the most important strategy goals in order to minimize the great gab between the national production and the consumption especially under the yearly increase in the population with more rate than production. Solving these problems need pressing hard to increase wheat yield. It can happen through two ways, one of that can go through producing highly productive varieties than the used under the recent cultivation (vertical extension). Other way can attain through cultivation wheat under the new reclaimed lands and desert invasion (horizontal extension), as well as increase the productivity of the soil by enhancing its fertility with different sources of fertilizers especially NPK which considered as one of the limiting factors to achieve the high yielding of wheat corp. Recently, much interest is focused on using bio-fertilizers to minimize consumption cost environmental pollution. [15], that potassium humate had significantly effect on wheat grains number/spike, grain weight/spike, grain yield and biomass. Nevertheless, it had not substantially effect on 1000-grain weight and plant height. [7], observed that increasing potassium application up to 90 kg/ha enhanced No. of tillering, No. of spikelet's/spike, No. of grains/spike, 1000- grain weight and wheat yield. [9], published that wheat grain yield response to K fertilizer is highly variable and is influenced by soil, crop and management factors. [10], reported that potassium fertilizer is needed for wheat growth. They added that, both water soluble and exchangeable soil K forms contributed 3% K and non exchangble K contributed 6.6 % K. [5], suggested that K fertilizer might enhanced protein content and 1000-kernal weight for wheat plants in favorable growing conditions of water availability. [13], announced that, K fertilization significantly increased wheat kernel number/spike, spike number/ha and grain weight (kg). Nutrient use efficiency of P was enhanced by K application.

Therefore, the present work aimed to study the effect of UN mineral K fertilizers packages on yield, and yield components for three promising wheat cultivars i.e. Masry1, Sakha93 and Baniswif 6 under pot and field experiments at Agric. Res. Station Fac. Agric. El-Azhar University Naser City (pot experiment) and El-Klag region Kaliobia Governorate, Egypt. (Field experiment).

ii. MATERIALS AND METHODS

Under the condition of sandy loam soil in Agriculture Farm, Faculty of Agriculture, Al Azhar University, three pot experiments were conducted during 2011/2012 and 2012/2013 seasons followed by field experiment conducted at El-klag region, Kaliobia Governorate, Egypt, during 2013/2014 to study the effect of applying some mineral or un mineral sources of potassium (Potassumage and banana ash) fertilizer on yield and yield components of three promising wheat cultivars Sakha-93, Masr-1 , Baniswif-6. The physical and chemical analysis of the soil site during the three growing seasons were recorded in Table (1),

The above-mentioned treatments were distributed to check it through three indicated experiments at seasons 2011/2012 and 2012/2013 were as follows:

The experiment treatment as follow:

A. first: - the pot experiment

The studied treatments:

a. Wheat cultivars:

1- Sakha-93

2- Masry-1

3- Baniswif-6

b. Potassium packages treatments

- Control "without using potassium " (k1)
- Potassiumag (bio-fertilizer) alone at the rate of 8 envelopes (k2)
- Banana ash 4% (K in the dry matter) at the rate of 600 kg/fed. by mixing the amount with soil (k3)
- Potassiumag at the rate of 8 envelopes/fed and added as described before+ Banana ash at the rate of 600 kg/fed. (k4)

These studied treatments were arrangement in complete randomized design with three replicates where the number of pots was 36. The pot or the experimental unit was a plastic pouch, its high equals 52 cm, it is circumference equals 78 cm and the surface area of pot equals 0.1074 cm.

Each one contained 75 g from composed that was added as general organic fertilizer beside the different weights from the studied treatments. Whereas phosphorene as bio-fertilizer were mixed with wheat grains at the rate of 0.5 g before sowing.

Super phosphate was added at the rate of 1.87 g for each pot according to the recommended dose (150 kg/fed.) whereas potassium sulphete was applied at the rate of 0.51 g for each one according to the recommended dose (50kg/fed.). Each pot contained five plants according to the optimum rate for the number of grains equals 90 plant/m2.

Irrigation was applied according to the determination of field capacity where the pots irrigate every 15 days until saturation. To avoid the losing of any amount of the additive fertilizer with irrigation water, plastic plates were put under every pot for saving the homogeneous between the experimental units due to the amount of water and the distribution of the different fertilizers.

Organic composed was applied to the all-experimental units at the rate of 75 g/pot, it equals 6 ton/fed. Table 1 cleared the chemical analysis of that used composed.

The sowing date was on the 20 of November in 2011/2012 and on the 22 of November in 2012/2013 season. The chemical and mechanical analysis for the experimental soil for both season were tabulated in Table 2

Table (1) chemical analysis of the applied compost during the three growing seasons

Determination	The pot experiments during		The field experiments during
	2011/2012	2012/2013	**2013/2014**
PH	7.8	7.7	**7.6**
O.M	38.11	38.33	**36.45**
EC(dsm-1)	4.71	4.65	**5.13**
C/N	14.8	14.72	**15.28**
N %	1.48	1.51	**1.43**
P %	0.55	0.56	**0.54**
K %	0.45	0.45	**0.46**
Fe (ppm)	1.25	1.28	**1.27**
Cu (ppm)	1.58	1.62	**1.59**
Zn (ppm)	1.82	188	**1.91**
Mn (ppm)	1.12	1.15	**1.21**

Table (2) some physical and chemical analysis of the experimental sites during the three growing seasons

Soil analysis	The pot experiments during		The field experiments during
	2011/2012	2012/2013	2013/2014
A-Physical analysis:			
-particle size distribution:			
Sand%	77.65	76.9	**72.7**
Clay%	10.35	10.8	**14.1**
Silt%	12	12.3	**13.2**
B-Chemical analysis:			
-catins(mg/L)			
Na^{++}	2.6	2.4	**1.88**
Mg^{++}	1.3	1.2	**1**
Ca^{++}	1.5	1.4	**2**
-Anions (mg/L).			
CL^{-}	1.91	1.88	**1.5**
So_4^{--}	2.6	2.71	**2.23**
HCO3	1.8	1.82	**1.6**

Soil analysis	The pot experiments during		The field experiments during
	2011/2012	2012/2013	2013/2014
CO3	0.0	0.0	**0.0**
PH	7.4	7.3	**8.2**
EC(dsm-1)	0.72	0.78	**0.4**
Cu^{+} (ppm)	0.6	0.52	**0.48**
Zn^{++}	0.65	0.72	**0.92**
Mn^{++}	4.2	4.3	**6**
Fe^{++}	1.87	1.92	**11**
Available N (ppm)	15	15	**15**
Available P (PPm)	137	135	**140**
Available K (PPm)	728	720	**604**
Texture	Sandy loam	Sandy loam	**Sandy loam**

B. The field experiment

The studied treatments: -

They were similar to those obtained in the pot experiments.

The split plot design with three replications was used in this experiment, whereas the tested wheat verities were allocated in the main pots. The area of each plot was 56m2 (16 × 3.5) and the four studied treatments of each experiment were devoted in the sub plots 14m2 (3.5 × 4m) for each.

The recommended dose of nitrogen (75 kg N/fed) and the half one (37.5kg N/fed) were added as Ammonium Nitrate 33.5%. Phosphorus fertilizer was applied at the rate of 150 kg/fed. (15.5% P2o5), while Potassium 1 was experimented at the rate of 50 kg/fed. (48.8% k2o), they were applied before sowing. Table 2 shows the mechanical and chemical properties of the experimental soil.

Sowing date was on the 28 of November in 2013/2014 season.

The studied characteristics:

At plant age of 75 days from planting the following growth, characters were measured on the five plants of each pot. During the field experiments, five plants were taken randomly to measure the same growth characters

Growth characters: -

1- Average plant height (cm).
2- Average number of tillers/plant.
3- Average flag leaf area (cm^2).

At maturity the five plant of each pot and/or plot were harvested to determine

Yield and yield components character: -

1- Number of spikes/plant.
2- Number of grains/spike
3- 1000-grain weight (g).
4- Grain yield per plant (g/plant) and per/fed. (ton/fed.) in the pot and field experiments respectively.
5- Straw yield per plant (g/plant) and per/fed. (ton/fed.) in the pot and field experiments respectively.
6- Biological yield per plant (g/plant) and per/fed.(ton/fed.) in the pot and field experiments respectively.
7- Harvest index (HI %): was determined according to the following formula
   Harvest index = Grain yield/ Total biological yield × 100

Statistical analysis: -

The complete randomized design with three replications for the pot experiments and the split plot design with three replications for the field experiment, as well as factorial arrangement were used. The obtained results subjected to statically analysis according to procedure outlined by [17], Means were compared using the least significant differences (L.S.D) test at 5% level of probability.

iii. RESULTS & DISCUSSION

A. Growth characters:

A.1. Varietal differences:

According Tables (3,4) the analysis of variance revealed significant differences among the means of the three tested wheat varieties for plant height, number of tillers/plant and flag leaf area during the three seasons. Sakha-93 wheat variety exceeded the other tested wheat varieties due to plant height (71.81, 72.19, and 73.90) and flag leaf area (66.08, 65.86, and 63.95) during the three seasons, while Banisweif-6 wheat variety surpassed the other tested wheat varieties due to the number of tillers/plant (5.14, 5.13 and 5.34). Moreover, Masr-1 wheat variety recorded intermediate estimates for the previous traits during the three seasons under the condition of pot and field experiments.

These results are in accordance with those reported by [12],

Table (3) Effect of some potassium fertilizer packages on plant height (cm) and no. of tillers/plant of the three wheat varieties in 2011/2012, 2012/2013 and 2013/2014 seasons.

character name	plant height (cm)														
season	2011/2012(pot exp.)					2012/2013(pot exp.)					2013/2014(field exp.)				
Varieties / N.fert.packge(	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha 93	68.51	72.00	73.22	73.51	71.81	69.05	72.56	73.20	73.97	72.19	70.00	74.00	75.60	76.02	73.90
Masr 1	66.02	69.09	70.08	71.29	69.12	67.03	69.71	70.38	71.06	69.55	68.00	72.00	74.00	74.50	72.13
Banisweif-6	64.15	66.44	67.56	69.09	66.81	64.48	66.47	67.37	69.25	66.89	65.12	69.00	72.00	73.00	69.78
Mean	66.23	69.18	70.29	71.30	69.25	66.85	69.58	70.32	71.43	69.54	67.71	71.67	73.87	74.51	71.94
LSD at 5 %															
Varieties (V)		1.81					1.71					3.11			
k.fertilizer(K)		2.09					1.97					2.20			
V X K		NS					NS					NS			

character name	No. of tillers														
season	2011/2012(pot exp.)					2012/2013(pot exp.)					2013/2014(field exp.)				
Varieties / N.fert.packge	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha 93	4.28	4.57	4.73	4.87	4.61	4.30	4.63	4.85	4.91	4.67	4.48	4.77	4.93	5.07	4.81
Masr 1	4.41	4.64	4.85	4.93	4.71	4.39	4.61	4.89	4.99	4.72	4.61	4.84	5.05	5.13	4.91
Banisweif-6	4.67	4.91	5.51	5.46	5.14	4.58	4.91	5.55	5.47	5.13	4.87	5.11	5.71	5.66	5.34
Mean	4.45	4.71	5.03	5.09	4.82	4.42	4.72	5.10	5.12	4.84	4.65	4.91	5.23	5.29	5.02
LSD at 5 %															
Varieties (V)		0.58					0.62					0.68			
k.fertilizer(K)		0.15					0.18					0.24			
V X K		NS					NS					NS			

K fertilizer package. k1=control k0 k2=potassiumag bactria
k3=banana ash k4=potassiumag bactria+banana ash

A.2. Potassium fertilizer packages effect:

The different potassium fertilizer packages treatment varied markedly in their mean values respecting growth character of wheat.

Results in the pot and the field experiments revealed that the application of potassiumag bacteria + banana ash (K4) gave the tallest wheat plant height (71.30, 71.43 and 74.51) and the greatest number of tillers/plant (5.09, 5.12 and 5.29) as well as resulted flag leaf area (66.07, 65.57 and 62.81) significantly higher as compared with the most other K fertilizer packages treatments. It worthy to mentioned that the differences between K3 and K4 treatments did not reach to the significant level during the three seasons under the condition of the pot and the field experiments. On the other hand, K1 treatment gave the lowest values of the previous traits (66.23, 66.85 and 67.71), (4.45, 4.42 and 4.65) and (62.67, 61.48 and 59.19) respectively, in the three seasons of the experimentation. These findings concur with [11], [7], [13] and [12],

A.3. Interaction effect:

The interaction effect between wheat varieties x K fertilizer packages showed insignificant effect on plant height, number of tillers/plant and flag leaf area during the three seasons under the condition of the pot and the experiments.

Yield and yield components:

B.1. Varietal differences:

Results recorded in Tables (5, 6 and 7), showed that, the yield and yield components trait's responded significantly owing to different tested wheat varieties in this respect, number of spikes/plant, reached its maximum value (4.41, 4.39, 4.44) with Banisweif-6 wheat variety under pot and field experiments followed by Masr-1 (4.23, 4.21, 4.19) and Sakha-93 varieties (4.13, 4.11, 4.13), which did not differ significantly from each other. However, Masr-1 wheat variety surpassed significantly the other two tested wheat varieties and produced the highest values of number of grains/spike (42.66, 43.06, 42.41), 1000 grain weight (51.80, 51.12, 39.56), yield of grains (10.71, 9.49, 2.37) and biological (25.71, 25.40, 6.33) per plant, per Fadden as well as harvest index (37.24, 37.69, 37.38) during the three seasons. Moreover, the differences between Sakha-93 and Banisweif-6 varieties did not reach to the significant level for 1000-grain weight and harvest index trait. In addition, nonsignificant varietal differences were detected between Sakha-93 and Masr-1 varieties for grain and biological yields per plant and per Fadden. On the contrary, Banisweif-6 wheat variety gave the lowest values for the studied yield and yield components in the three seasons under the pot and the field experiments (41.97, 41.97, 33.25), (7.94, 7.59, 1.96), (14.00, 13.73, 3.54), (21.95, 21.32, 5.50) and (36.10, 35.46, 35.53) respectively, Similar varietal differences in grain yield per plant and per Fadden were given by [8], and [4],

B.2. Potassium fertilizer packages effect:

The results revealed that the different K fertilizer packages treatments attained significant effects on all yield and yield components of wheat in the three seasons, whereas potassiumag bacteria + banana ash (K4) recorded the best results in each of number of grains/spike (43.89, 43.67, 39.95), 1000 grain weight (51.00, 50.90, 39.20), grain yield (9.90, 9.76, 2.38), straw yield (15.91, 15.83, 3.99) and biological yield (25.81, 25.61, 6.37) and harvest index (38.34, 38.05, 37.39) during the three seasons under the pot and the field experiment. In addition, results showed that K3 treatment ranked the second respecting yield and yield components traits under the pot and the field experiment, without significant differences between K3 and K4 treatments in this respect. Moreover, K1 treatment recorded the lowest levels for all yield and yield components traits under the pot and the field experiment, (40.06, 40.26, 38.47), (45.14, 42.63, and 33.24), (7.37, 7.06, and 1.94), (14.31, 14.11, and 3.58), (21.68, 21.17, and 5.62) and (33.98, 33.28, 34.48). The results were also valid previously by [15], [19], and [14].

B.3. Interaction effect:

The effect of interaction between wheat varieties and K fertilizer packages treatments were significant on grain yield/plant in the first season (pot experiment) in this respect the best result of grain yield/plant was recorded for Masr-1 wheat variety when fertilized with potassiumag bacteria + banana ash (K4), (10.71, 10.61 and 2.54), Other interaction between wheat varieties and K fertilizer packages treatments was not significant.

Table (4) Effect of some potassium fertilizer packages on flag leaf area (cm2) and no. of spikes/plant of the three wheat varieties in 2011/2012, 2012/2013 and 2013/2014 seasons.

character	Flag leaf area (cm2)														
season	2011/2012(pot exp.)					2012/2013(pot exp.)					2013/2014(field exp.)				
K.fert.packge / Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	63.99	66.02	66.56	67.74	66.08	62.29	66.31	66.83	68.00	65.86	61.86	63.92	64.86	65.15	63.95
Masr-1	62.88	64.79	65.06	66.22	64.74	61.17	64.06	64.15	65.33	63.68	61.12	63.02	63.90	64.85	63.22
Banisweif-6	61.14	61.72	63.12	64.24	62.55	60.99	62.52	62.73	63.39	62.41	54.59	57.08	57.80	58.43	56.97
Mean	62.67	64.18	64.92	66.07	64.46	61.48	64.30	64.57	65.57	63.98	59.19	61.34	62.19	62.81	61.38
LSD at 5 %															
Varieties (V)		1.24					1.23					2.13			
N.fertilizer(K)		1.43					1.42					1.38			
V x K		NS					NS					NS			

Table (17b) Effect of some potassium fertilizer packages on number of spikes/plant of the three wheat varieties in 2011/2012, 2012/2013 and 2013/2014 seasons.

character	No. of spikes/plant														
season	2011/2012(pot exp.)					2012/2013(pot exp.)					2013/2014(field exp.)				
K.fert.packge / Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	3.95	4.06	4.18	4.31	4.13	3.90	4.08	4.21	4.26	4.11	4.02	4.11	4.21	4.19	4.13
Masr-1	4.02	4.17	4.31	4.40	4.23	4.04	4.21	4.29	4.32	4.21	4.02	4.20	4.25	4.29	4.19
Banisweif-6	4.16	4.36	4.55	4.57	4.41	4.15	4.33	4.53	4.56	4.39	4.20	4.38	4.57	4.61	4.44
Mean	4.05	4.20	4.35	4.43	4.25	4.03	4.21	4.34	4.38	4.24	4.08	4.23	4.34	4.36	4.26
LSD at 5 %															
Varieties (V)		0.11					0.11						0.18		
N.fertilizer(K)		0.13					0.12						0.13		
V x K		NS					0.21						NS		

K fertilizer package. k1=control k0 k2=potassiumag bactria
k3=banana ash k4=potassiumag bactria+banana ash

Table (5) Effect of some potassium fertilizer packages on flag no. of grains/spikes and 1000-grain weight (g) of the three wheat varieties in 2011/2012, 2012/2013 and 2013/2014 seasons.

character	No. of grains /spike														
seasons	2011/2012(pot exp.)					2012/2013(pot exp.)					2013/2014(field exp.)				
K.fert.packge / Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	39.10	42.11	43.16	43.38	41.94	39.08	42.03	43.15	43.34	41.90	39.45	41.08	41.00	41.13	40.67
Masr-1	40.03	43.44	43.52	43.67	42.66	41.53	43.46	43.59	43.64	43.06	39.62	42.45	43.70	43.86	42.41
Banisweif-6	41.06	41.97	42.20	44.63	42.47	40.17	40.92	41.63	44.63	41.84	36.35	37.30	37.75	34.87	36.57
Mean	40.06	42.51	42.96	43.89	42.36	40.26	42.14	42.79	43.87	42.27	38.47	40.27	40.82	39.95	39.88
LSD at 5 %															
Varieties (V)		1.08					1.02					1.68			
k.fertilizer(K)		1.25					1.18					1.24			
V x K		N.S					N.S					N.S			

character	1000- grain weight (g)														
seasons	2011/2012(pot exp.)					2012/2013(pot exp.)					2013/2014(field exp.)				
K.fert.packge / Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	45.90	53.62	52.18	53.26	51.24	45.20	50.93	52.87	53.73	50.68	34.02	37.95	39.03	40.63	37.91
Masr-1	46.23	52.03	53.83	55.10	51.80	45.40	51.40	53.37	54.33	51.12	35.54	38.78	41.82	42.10	39.56
Banisweif-6	37.30	42.63	43.30	44.63	41.97	37.30	42.63	43.30	44.63	41.97	30.16	33.60	34.39	34.87	33.25
Mean	43.14	49.43	49.77	51.00	48.34	42.63	48.32	49.84	50.90	47.93	33.24	36.78	38.41	39.20	36.91
LSD at 5 %															
Varieties (V)		1.24					1.17					1.64			
k.fertilizer(K)		1.43					1.36					1.11			
V x K		NS					NS					NS			

K fertilizer package. k1=control k0 k2=potassiumag bactria
k3=banana ash k4=potassiumag bactria+banana ash

Table (6) Effect of some potassium fertilizer packages on grain and straw yields (g/plant and ton/fed.) of the three wheat varieties in 2011/2012, 2012/2013 and 2013/2014 seasons.

character	Grain yield														
season	2011/2012(pot exp. g/plant)					2012/2013(pot exp. g/plant)					2013/2014(field exp. ton/fed)				
K.fert.packge(/ Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	7.39	9.33	10.03	10.20	9.24	7.40	9.23	9.90	10.25	9.19	2.03	2.23	2.33	2.41	2.25
Masr-1	7.98	9.81	10.36	10.71	9.72	7.65	9.49	10.21	10.61	9.49	2.10	2.40	2.43	2.54	2.37
Banisweif-6	6.75	7.61	8.63	8.79	7.94	6.12	7.67	8.16	8.41	7.59	1.70	1.87	2.07	2.19	1.96
Mean	7.37	8.92	9.67	9.90	8.97	7.06	8.80	9.42	9.76	8.76	1.94	2.17	2.28	2.38	2.19
LSD at 5 %															
Varieties (V)		0.23					0.22					0.10			
k.fertilizer(k)		0.27					0.26					0.07			
V x K		0.46					NS					NS			
character	Straw yield														
season	2011/2012(pot exp. g/plant)					2012/2013(pot exp. g/plant)					2013/2014(field exp.ton/fed)				
K.fert.packge / Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	14.92	16.02	16.51	16.59	16.01	14.99	15.99	16.57	16.63	16.05	3.82	4.02	4.12	4.14	4.02
Masr-1	14.48	15.93	16.72	16.86	16.00	14.46	15.88	16.50	16.79	15.91	3.91	3.95	4.02	4.11	4.00
Banisweif-6	13.52	14.00	14.21	14.28	14.00	12.88	13.90	14.02	14.14	13.73	3.32	3.48	3.64	3.72	3.54
Mean	14.31	15.32	15.81	15.91	15.34	14.11	15.26	15.70	15.85	15.23	3.68	3.82	3.93	3.99	3.85
LSD at 5 %															
Varieties (V)		0.39					0.37					0.16			
k.fertilizer(K)		0.46					0.44					0.12			
V x K		NS					NS					NS			

K fertilizer package. k1=control k0 k2=potassiumag bactria
k3=banana ash k4=potassiumag bactria+banana ash

Table (7) Effect of some potassium fertilizer packages on biological yield (g/plant and ton/fed.) and harvest index of the three wheat varieties in 2011/2012, 2012/2013 and 2013/2014 seasons.

character	Biological yield														
season	2011/2012(pot exp. g/plant)					2012/2013(pot exp. g/plant)					2013/2014(field exp.ton/fed)				
K.fert.packge / Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	22.31	25.35	26.54	26.79	25.25	22.39	25.22	26.47	26.88	25.24	5.85	6.25	6.44	6.55	6.27
Masr-1	22.47	25.74	27.08	27.57	25.71	22.11	25.37	26.71	27.40	25.40	6.01	6.20	6.45	6.65	6.33
Banisweif-6	20.27	21.61	22.84	23.07	21.95	19.00	21.57	22.18	22.55	21.32	5.02	5.35	5.71	5.92	5.50
Mean	21.68	24.23	25.49	25.81	24.30	21.17	24.05	25.12	25.61	23.99	5.62	5.93	6.20	6.37	6.03
LSD at 5 %															
Varieties (V)		0.63					0.59					0.26			
k.fertilizer(K)		0.72					0.68					0.18			
V x K		NS					NS					NS			
character	Harvest index														
season	2011/2012(pot exp.)					2012/2013(pot exp.)					2013/2014(field exp.)				
K.fert.packge / Varieties	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean	k1	k2	k3	k4	Mean
Sakha-93	33.11	36.81	37.78	38.08	36.45	33.05	36.59	37.39	38.14	36.29	34.71	35.74	36.12	36.83	35.85
Masr-1	35.53	38.12	38.26	38.85	37.69	34.60	37.41	38.23	38.72	37.24	34.90	38.71	37.69	38.22	37.38
Banisweif-6	33.29	35.22	37.78	38.11	36.10	32.20	35.56	36.80	37.29	35.46	33.82	34.95	36.23	37.11	35.53
Mean	33.98	36.72	37.94	38.34	36.74	33.28	36.52	37.47	38.05	36.33	34.48	36.46	36.68	37.39	36.25
LSD at 5 %															
Varieties (V)		0.95					0.94					0.91			
k.fertilizer(K)		1.10					1.08					1.03			
V x K		NS					NS					NS			

K fertilizer package. k1=control k0 k2=potassiumag bactria
k3=banana ash k4=potassiumag bactria+banana ash

iv. DISCUSSION

The third So-called major element required for plant growth is potassium. It is absorbed as the potassium ion K+ and is found in soils in varying amounts, but the fraction of the total potassium in the exchangeable or plant available form is usually small. Fertilizer potassium is added to soils in the form of mineral as potassium chloride KCL and potassium sulphate (K2 So4) and so on in the recent years many investigations tend to use K organic and bio fertilizer i.e. banana ach and potassiumag.

It is interesting to note that, potassium is a mobile element, which is translocated to the younger, meristematic tissues if a shortage occurs. This element plays an important role and contributes in such physiological function, i.e. carbohydrate metabolism (formation and breakdown as well as translocation of starch), nitrogen metabolism and synthesis of proteins, control and regulation of activities of various essential mineral elements, neutralization of physiologically important organic acids, activation of various enzymes, promotion of meristematic tissue growth and adjustment of stomatal movement and water relations.

On the other hand, potassium shortage is frequently accompanied by a weakening of the straw of grain crops, which results in lodging of small grains. The over-all effects of K deficiency on plant growth and quality are the result of the accompanying physiological aberrations within the plant system, i.e. potassium is responsible for the activation of

Pyritic kinas in some plants [18], Photosynthesis is decreased with insufficient potassium, whereas at the same time respiration may be increased. This seriously reduces the supply of carbohydrates and consequently plant growth.

The role of K in maintaining adequate water relations in plants is an important one. Maintenance of plant turgor is essential to the proper functioning of photosynthetic and metabolic processes, some of investigators suggested that in potassium deficient plants non protein nitrogen accumulates in the leaves, whereas other studies have shown that free amino acids accumulate in the leaves of K-deficient barley plants and that in extremely and deficient plants the concentration of these free acids decreases with an increase in the concentration of amides.

With regard to the factors affecting potassium equilibria in soils, certain factors are known to influence the conversion of soil and added potassium to less available forms some of these are: type of colloid, temperature, wetting and drying and soil pH.

Concerning type of colloid, it was concluded that organic matter (humus or composed) although possessed of a great capacity to certain K+ and other cations in the exchangeable form, has no capacity whatever for the fixation of this element.

The equilibria will shift in the direction of the unavailable forms of potassium especially in clay soil. Large addition of fertilizer potassium over periods will result in less fixation of subsequent applications and an increase in the content of exchangeable potassium [1], and [2], With respect to the effect of soil temperature, many of investigations confirmed that an increase in temperature resulted in an increase in the level of exchange enable potassium. Respecting to, wetting and drying, when field-moist soils are dried, there is usually an increase for K that can be extracted from these soil; this is particularly true when the levels of soil potassium are medium to low. On the other hand, the effect of pH on the fixation and release of soil potassium has been a controversial subject among soil scientists for many years.

They demonstrated that, the greater the degree of calcium saturation, the greater the absorption by clay of K from the soil solution [3], Relying on the above mentioned observations and discussions, it was demonstrated that the application of potassium bio fertilizer such as potassium age and banana ash as organic source of K increased soil temperature as a result of the potassium age action that helps in dissolving soil dry matter and raising that factor, this will be increased the uptake and exchangeable of K+ ion, also the relation between pH and soil calcium saturation that enhancing the uptake and exchangeable of that element.

From the above mentioned reasons, the addition of K in the form of bio fertilized to wheat grains increased substantially plant height, No. of tillers/ plant, flag leaf area (cm2), No. of spikes / plant, No. of grains / spike, 1000-grain weight (g) grain and straw yield / plant and fed., biological yield (g/plant and ton/fed.), harvest index and grain protein content %, as comparing with untreated plants (0.0 K bio fertilizer that awarded the lowest values of these traits.

Eventually, most of the studied traits were not affected significantly with (var. x K fertilizer), with the exception of no. of spikes / plant (during 2012 / 2013 season) treating Bansweif-6 var. with potassiumage bacteria + banana ash (K4) produced the highest no. of spikes / plant, whereas fertilizing Masr-1 var. with the same treatment (K4) awarded the highest yield of grain. (2011 / 2012 season).

The superiority of that two studied varieties may be ought to the genetically difference and carbon equivalent between wheat varieties, as well as their variance due to photosynthesis efficiency, uptake of more water and minerals from soil, these expatiation was supported by [16],

v. CONCLUSION

It could be concluded that bio fertilization approach and using of natural mineral amendments like potassiumag, are consider an effective strategy for saving chemical fertilizer use and diminishing the risks of environmental pollution particularly with implying wheat production as an important cereal crops sustainable agriculture system.

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