

## **EFFECT OF DIFFERENT FOLIAR CONCENTRATION OF SOME BIO-STIMULATORS ON EGYPTIAN CLOVER IN CALCAREOUS SOIL.**

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### **ABSTRACT**

A field experiment was carried out during winter season 2018 / 2019 in Maryout the agriculture experiment station of the Desert Research Center, south west Alexandria, Egypt to study the influence of foliar application of Humic acid, mixture of Amino acids and Active dry yeast and their interaction on the productivity and chemical contents of Egyptian clover (var. Meskawey) grown in calcareous soil. The experiment was planned in a split- split plot design with three replicates. The main plots were applying foliar spray of Active dry yeast include three levels ( 0 , 2 , 4 g / L ) ,the subplots included foliar spray of three levels of Humic acid ( H ) , i.e. ( 0 , 2 , 4 ml / L) and sub –sub plots was the mixture of Amino acid (A) sprayed at rates ( 0 , 2 , 4 ml / L ) . Foliar spray of the studied treatments were added using four doses , first after 25 days from planting , 2<sup>nd</sup> , 3<sup>rd</sup> and 4<sup>th</sup> after 10 days of each cutting .

Results showed that spraying Egyptian clover 4 through times of bio stimulators active dry yeast (4 g /L), combined with humic acid (4 ml /L ) and amino acid ( 4 ml /L) were the most effective treatment in improving fresh and dry forage yields ton /fed, which recoded ( 46.88 and 8. 52 ton / fed), respectively through the whole season and which record the highest protein % were 15.4 , 18 , 18.2 and 18.6 % for the 1<sup>st</sup> , 2<sup>nd</sup> , 3<sup>rd</sup> and the 4<sup>th</sup> cuts , respectively. Also, this treatment recoded the highest values of nitrogen, potassium, phosphorus as concentration and uptake in the dry forage of Egyptian clover.

### **INTRODUCTION**

Egyptian clover, or berseem, (*Trifolium alexandrinum* .L ), is a very important crop, for fodder and soil fertility maintenance, which was domesticated in Egypt and now is widespread in irrigated cropping systems in west and south Asia and used in commercial farming in many countries with mild winter. Foliar application technology is an integral part of root feeding which is one of the important factors in minimizing losses and rationalizing the high quantities of chemical fertilizers, as well as increasing the efficiency of the use of fertilizer that applied to the soil its direct and rapid effect, **Sanyal et al., (2018)**.

Yeast, foliar sprays of bio-stimulant as humic acid and yeast substances have promoted the growth and increases the yield and the quality for a number of plant species .It is increased nutrients uptake, serving as a source of mineral plant nutrients and regulator of their nutrients release (**El-Nemr et al., 2012**). The bio-stimulators can be applied in the root zone or on the leaves. **Abdel Nabi et al., (2014)** showed that foliar spraying of cantaloupe plants with yeast extract at  $5\text{ g L}^{-1}$  significantly surpassed other treatments (without treatments, spraying with EM or Agrispon) and produced the highest values of all the studied parameters of growth and yield. **Ahmed et al., (2013)** showed that increasing foliar application of active yeast extracts up to  $4\text{ g L}^{-1}$  improved the vegetative growth characters of potato plants as expressed as plant length, stems, leaves number/plant, leaf area /plant, fresh and dry weights of the whole plant as well as gave the highest total tuber yield. **Shehata et al., (2012)** studied the effect of foliar application of yeast rates (1, 2, 3 and  $4\text{ g L}^{-1}$ ) on cucumber yield and its component where they showed that active dry yeast increased significantly cucumber yield, number of fruits/plant, average weight of fruit, fruit length and fruit diameter. Also, they mentioned that yeast is an enriched source of phytohormones especially cytokinins, vitamins, enzymes, amino acids and minerals as well as has a stimulatory effect on the cell division and enlargement, protein and nucleic acids synthesis, chlorophyll formation and protective role against different stresses.

Humic acid play a prominent role in various physiological and biochemical processes related to environmental stresses .Humic substances have been shown to stimulate shoot and root growth and nutrients uptake of vegetable crops ,**Akinremi et al., ( 2000)** . Humic acid have ecological importance, as they intervene in the regulation of a large number of chemical and biological processes that occur in the natural ecosystems, **Chen. et al., (2004)**. One of the strategies to improve forage productivity is the foliar application with humic and fulvic acids as well as amino acids. Foliar spraying with 10 ml/L K-humate (10%  $\text{K}_2\text{O}$ ) increased significantly plant height, number of secondary branches /plant, number of heads /plant, dry leaf /stem ratio, number of seeds /head, 1000 seed weight, fresh and dry fodder yields as well as seed yield, followed by foliar spray with 10 ml/L amino acids mixture and the maximum values of crude protein , N , P and K% were obtained from treated plants by 10 ml/L K-humate followed by 10 ml/L amino acids mixture compared to control **Fadia Sultan et al., ( 2016)**. **Asik. et al., (2009)** reported that the lowest doses of both soil and foliar application of humic substances increased the nutrient uptake of wheat. Furthermore, **El-Hefny (2010)** reported significant increases in plant height, number of branches, fresh weight, leaf area /plant, total pods

yield, N, P, K uptake as well as protein and carbohydrate contents in cowpea seeds with increasing the rate of humic acid application from 1, 3, 4.5 up to 6 kg/fed. **Ghorbani. et al., (2010)** reported that spraying with humic acid showed remarkable effects on vegetative growth of plant and increases photosynthetic activity and increasing leaf area. **El-Nemr et al., (2012)** found that spraying HA and bio-stimulators through foliar application led to a positive effect on plant growth, fruit-set, yield quantity and quality of cucumber plants. **Hafez et al ( 2020 )** studied the effect of the fertigation with four combinations of both humic (H) and Amino acids (A) as (control, 2 L H , 2 L A and 2 L H + 2 L A /fed) as well as the foliar application of three rates of potassium silicate (KS), i.e. , (O, 5 and 10 g) KS / L on the growth, yield parameters, quality content, uptake of N and K of bulb onion plants ,which found that best treatment was observed with the integration treatment of (H + A + 10g KS/l) which gave the highest mean values of growth, yield, yield component and quality parameters (TSS %, Protein % and carbohydrates %) during the studied two seasons.

Amino acids are important for stimulation of cell growth. They contain both acid and basic groups and act as buffers, which help to maintain favorable pH value within the plant cell. Recently, studies have proved that amino acids can directly or indirectly influence the physiological activities in plant growth and development. Also, amino acids are well known as bio stimulants, which have positive effects on plant growth, yield and significantly mitigate the injuries caused by abiotic stresses (**Kowalczyk and Zielony, 2008**). **Liu et al., (2008)** revealed that foliar application with the mixture of amino acids to radish plants increased N content of shoots. **El-Zohiri and Asfour (2009)** on potato found that spraying of amino acids at 0.25 ml /l significantly increased vegetative growth expressed as plant height and dry weight of plant. **Abo Sedera et al., (2010)** revealed that spraying strawberry plants with amino acids (peptone) at 0.5 and 1.0 g /l significantly increased total nitrogen, phosphorus and potassium in plant foliage as well as total yield, weight of plant TSS, vitamin C and total sugars content of fruits compared with control treatment. Studies have proved that amino acids can directly or indirectly influences the physiological activities in plant growth and development. Many studies reported that, the foliar application of amino acids caused an enhancement in plant growth, fruits yield and its components, on cucumber **Karuppaiah et al., (2000)**, **El-Shabasi (2005)**.on garlic, and **Awad et al., (2007)** on potato. **Perez et al., (2015)**, mentioned that the amino acids activate plant synthesis efficiency and internal immunity in addition improves the qualities of growth and yield.

Accordingly, this study aims to study the effect of foliar spray with Active dry yeast, humic acid and mixture of Amino acids and their interactions on the growth, productivity and chemical contents of Egyptian clover (c.v. Meskawey) grown in calcareous.

### MATERIALS AND METHODS

The present investigation was carried out during the season of 2018 / 2019 in the Agricultural Experimental Station of the Desert Research Center at Maryout station, 40 km south –west of Alexandria, Egypt.

The experiment was planned in a split- split plot design with three replicates. The main plots were applying of three levels of Active dry yeast include three rates ( 0 , 2 and 4 g / L ), the subplots included foliar spraying with Humic acid ( H ) at rates of ( 0 , 2 , 4 ml / L ), and sub –sub plots were three levels foliar Amino acids mixture at rates of ( 0 , 2 and 4 ml / L). Foliar spraying of the treatments were added as four times, first after 25 days from planting, which 2<sup>nd</sup> , the 3<sup>rd</sup>. and the 4<sup>th</sup> after 10 days of each cutting. Egyptian clover, (*Trifolium alexandrinum* .L var. Meskaway ) seeds were sown directly ate rate of 60 kg/ fed in the soil at November 20<sup>th</sup>.

All plots were fertilized with the recommended rates of nitrogen (40 kg N/fed) as ammonium sulphate and (200 kg) superphosphate and K sulphate, (100 kg / fed). Nitrogen , P and K fertilizers were added through twice doses before cultivation and after 25 days from planting, also organic manure (farmyard manure ) at rate of 5 ton /fed was added during soil preparation .The experiment included 27 experimental units , includes 3 Hmic acid treatments , 3 rates of mixture Amino acids and 3 rates of Active dry yeast .The plot area was (10.5 m<sup>2</sup>) , 3.5 x 3 m long and wide ( 1/400 fed) . Seeds before cultivation treated with bio- fertilizer containing the symbiotic N- Fixing bacteria of (*Rhizobium leguminosarum*) which provided by Soil Microbiology Unit, Soil Fertility and Microbiology Department, Desert Research Center, Cairo Egypt. The soil and irrigation water were analyzed at the laboratories of Desert Research Center, as shown in Tables (1 A, B and 2).

**Table 1- A. Some chemical properties of the experimental soil.**

Soil depth (cm)	pH	CaCO <sub>3</sub> %	OM %	E. C dSm <sup>-1</sup>	Soluble Cations ( me/ l)				Soluble Anions ( me/ l)		
					Ca <sup>++</sup>	Mg <sup>++</sup>	Na <sup>+</sup>	K <sup>+</sup>	HCO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>=</sup>	Cl <sup>-</sup>
0 - 30	7.7	28	0.61	4.85	21.57	13.62	12.5	1.1	6.23	20.98	21.24
Available nutrients (ppm)	N		P		K		Fe		Mn	Zn	Cu
	35		7.83		13.5		1.7		5.03	0.86	1.4

pH : Acidity, soil extract ( 1 :2.5 ) , E .C :Electrical conductivity me/ l: mille equivalent per Liter OM = organic matter

**Table 1- B - Some physical properties of the experimental soil.**

Site	Particle size distribution				Texture class
	Coarse sand %	Fine sand%	Silt %	Clay %	
Maryout	5	41.8	35.0	18.2	SCL

SCL = Sandy clay loam

**Table 2. Chemical analysis of the applied irrigation water.**

Parameters	pH	E. C dSm <sup>-1</sup>	Soluble Cations ( me/l)				Soluble Anions ( me/l )		
			Ca <sup>++</sup>	Mg <sup>++</sup>	Na <sup>+</sup>	K <sup>+</sup>	HCO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>-</sup>	Cl <sup>-</sup>
Values	7.5	2.8	8.59	10.43	8.7	0.42	6.83	5.58	15.6

pH : Acidity, E.C :Electrical conductivity me/l: mille equivalent per Liter

A liquid commercial product of the used humic acid substance consists of. humic acid 91 % , 1% P , 1% Fe and 1% Zn . The liquid commercial product of amino acids mixture consists of (0.56% leucine, 1.91% alanine, 1.8% valine, 0.42% arginine, 8.1% glutamic, 0.62% aspartic, 2.33% lysine, 0.41% threonine, 2.36% phenylalanine, 0.40% histidin, 2.37% tyrosine, 2.55% glycine, 0.42% isoleucine, 0.29% serine, 0.46% proline), 4% N, 5% K<sub>2</sub>O and 1% P<sub>2</sub>O<sub>5</sub> were used as a source of amino acids mixture. Yeast extract was prepared from yeast (*saccharomyces cerevisiae*), dissolved in water followed by adding sugar at a ratio of 1: 1 and kept 24 hours in a warm place for reproduction according to the methods of Marzauk et al., ( 2014 ) chemical analysis of activated yeast is shown in Table ( 3 ) .

**Egyptian clover Yield:**

At harvest time, 1 m<sup>2</sup> was taken from the center of each plot of the trial to determine the fresh and dry forage yield kg/ fed. All Egyptian clover plants for each plot plants was harvested to determine: fresh forage yield, dry forage yield and accumulative through the whole season (ton /fed.)

**Table (3). Chemical analysis of activated yeast (mg /100 gm dry weight).**

Mineral	Amino acids		Vitamins		
Total N	7.23	Arginine	1.99	Thiamin	2.71
P <sub>205</sub>	51.68	Histidine	2.63	Riboflavin	4.96
K <sub>20</sub>	34.39	Isoleucine	2.31	Nicotinic acid	39.88
Mgo	5.76	Leucine	3.09	Pantothenic acid	19.56
Cao	3.05	Lysine	2.95	Biotin	0.09
Sio <sub>2</sub>	1.55	Methionine	0.72	Pyridoxine	2.90
So <sub>2</sub>	0.49	Phrylalanine	2.01	Folic acid	4.36
Nacl	0.30	Threonine	2.09	Cabalamine	153 ug
Fe	0.92	Tryptophan	0.45	Oxidase	0.350
Ba	1.67	Valine	2.19	Peroxidase	0.290
Co	6.8	Glutamic acid	2.00	Catalase	0.063
Pd	4.39	Serine	1.59	Carbohydrates	23.20
Mn	8.1.3	Aspartic acid	1.33		
Sn	2.24	Praline	1.53		
Zn	3.36	Tyrosine	1.49		

**Chemical contents of shoot:**

Nitrogen, phosphorus and potassium were determined in the digested dry matter of Egyptian clover shoots which oven dried at 70<sup>0</sup> for 72 hours then fine ground and wet digested according to **Peterburgski, (1968)** to determined N, P, K % according to **Chapman and Pratte (1982)**. Total nitrogen was determined using Microkjeldahl method, Phosphorus content was determined by spectrophotometer, Potassium percentage was determined by using Flame photometer, protein (%) determination by multiplying N% of shoot × 6.25.

**Statistical Analysis:**

All data were statistically analyzed according to **Snedecor and Cochran (1982)**, where treatments means was compared using L.S.D.test at 0.05 probability level.

**RESULTS AND DISCUSSION****Egyptian clover Yield:**

Foliar spraying of growth promoter substances, *i.e.*, active dry Yeast, humic acid and the mixture of the amino acids had a significant effects on, fresh forage , dry forage and accumulative yields (ton / fed ), as shown in (Table 4 ).

It is noticed that increasing spraying with active dry yeast increased significantly the fresh, dry yields through the taken four cuts and the accumulative yield .The addition of the high rate of yeast ( 4 g / L ) had recorded the highest mean values of fresh and dry forage yields ton /fed during the four cuts. The increases of 1<sup>st</sup> , 2<sup>nd</sup> , 3<sup>rd</sup> and 4<sup>th</sup> cuts , reached about 76.2 , 52.5 , 52.9 and 85.8% for fresh forage while being 85.2 , 55 , 57.5 and 95.8 % for the dry forage yields /fed , respectively. The highest mean values were 10.633 and 1.886 (ton / fed) with 3<sup>rd</sup> for fresh and dry forage yields, where, the lowest mean values were 7.816, 1.386 ton /fed for fresh and dry forage yields with the 4<sup>th</sup> cut .Furthermore, the highest mean values of the accumulative fresh and dry forage yields were 37.87 and 6 .727(ton /fed), and percentage increase reached about 63.9 and 69.5% with high spraying rate of yeast compared with control treatment. This increase may due to the role of the addition active dry yeast, **Ahmed. et al. (2013)** showed that increasing of foliar application of active yeast extracts up to 4 g L<sup>-1</sup> improved the vegetative growth characters of potato. **Shehata et al., (2012)** studied the effect of foliar application of yeast rates (1, 2, 3 or 4 g L<sup>-1</sup>) on cucumber yield and its component and showed that active dry yeast increased significantly cucumber yield, number of fruits/plant, average weight of fruit, fruit length and fruit diameter. Also, **Shehata et al., (2012)** mentioned that yeast is an enriched source of phytohormones especially cytokinins, vitamins, enzymes, amino acids and minerals as well as has a stimulatory effect on the cell division and enlargement, protein and nucleic acids synthesis, chlorophyll formation and protective role against different stresses .

Table (4). Effect of the studied treatments on fresh and dry yields of Egyptian clover through four cuts.

Yeast g/l Y	Humic Acid ml/l H	Amino Acid ml/l A	Fresh yield ( ton /fed)				Total Accu	Dry forage yield ( ton /fed)				Total Accu
			1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
0	0	0	5.197	6.763	6.947	4.207	23.114	0.8819	1.1787	1.2006	0.7076	3.9688
		2	5.713	7.55	7.747	5.257	26.267	0.9877	1.3036	1.3439	0.889	4.5242
		4	6.627	8.477	8.647	5.43	29.181	1.1334	1.4514	1.484	0.9363	5.0051
	2	0	6.657	7.413	7.577	5.39	27.037	1.1749	1.3062	1.3415	0.9406	4.7632
		2	6.813	8.883	9.327	5.523	30.546	1.2028	1.6003	1.6498	0.9619	5.4148
		4	8.07	8.963	9.607	6.53	33.17	1.4305	1.5828	1.6956	1.1443	5.8532
	4	0	6.993	8.047	8.363	5.683	29.086	1.2599	1.4612	1.5013	1.0122	5.2346
		2	7.523	9.98	10.39	6.027	33.92	1.3573	1.8048	1.758	1.0821	6.0022
		4	8.05	10.71	10.93	6.427	36.117	1.4516	1.9262	1.975	1.1518	6.5046
2	0	0	6.08	7.043	7.18	5.13	25.433	1.0314	1.2178	1.2348	0.8872	4.3712
		2	6.63	7.857	8.144	6.22	28.851	1.1459	1.3633	1.404	1.0586	4.9718
		4	7.787	8.893	9.29	6.49	32.46	1.3371	1.5424	1.5847	1.0936	5.5578
	2	0	8.523	9.427	9.647	7.387	34.984	1.5021	1.6707	1.7135	1.3007	6.187
		2	8.947	10.53	10.8103	7.72	38.0073	1.5931	1.8671	1.9096	1.3603	6.7301
		4	9.293	10.923	11.243	8.503	39.962	1.6356	1.934	1.9898	1.4961	7.0555
	4	0	9.667	10.677	10.927	8.233	39.504	1.7456	1.9257	1.9095	1.5022	7.083
		2	10.367	11.793	12.1	9.363	43.623	1.8748	2.1381	2.2059	1.6855	7.9043
		4	10.84	12.217	12.473	9.367	44.897	1.9507	2.2184	2.2486	1.6913	8.109
4	0	0	6.563	7.227	7.403	5.713	26.906	1.127	1.2305	1.2723	0.9834	4.6132
		2	7.89	8.223	8.45	6.457	31.02	1.346	1.4272	1.4614	1.0956	5.3302
		4	7.81	9.077	9.517	6.553	32.957	1.3525	1.5676	1.6252	1.1277	5.673
	2	0	8.98	9.877	9.977	7.633	36.467	1.5887	1.7523	1.7711	1.3491	6.4612
		2	9.917	11.057	11.313	8.373	40.66	1.7591	1.9664	2.0019	1.4747	7.2021
		4	10.227	11.287	11.573	8.42	41.507	1.8079	2.0138	2.0451	1.4973	7.3641
	4	0	9.68	10.237	11.007	8.427	39.351	1.7699	1.8734	1.9433	1.5387	7.1253
		2	10.433	12.36	13.09	9.2	45.083	1.9079	2.2645	2.3996	1.6795	8.2515
		4	10.953	12.997	13.363	9.567	46.88	1.9841	2.3627	2.4504	1.7265	8.5237
LSD at 0.05												
Y		0.043	0.0048	0.072	0.039	0.12	1.3	1.4	102.4	1.5	0.11	
H		0.199,	0.199	0.281	0.222	0.87	20.5	20.4	129.2	17.7	0.12	
A		0.050,	0.056	0.196	0.059	0.23	4.3	4.5	109.6	3.9	0.11	
Y×H		0.074	0.083	0.124	0.066	0.21	2.3	2.4	177.4	2.5	0.18	
Y×A		0.074	0.083	0.124	0.066	0.21	2.3	2.4	177.4	2.5	0.18	
H×A		0.086	0.097	0.339	0.102	0.40	7.47	7.8	189.9	6.8	0.19	
Y×H×A		0.128	0.143	0.215	0.115	0.36	4.0	4.1	307.3	4.4	0.32	

Also, data indicating that increasing spraying rate of humic acid increased significantly the fresh and dry forage yields through the taken four cuts and the accumulative yields, the increases reached about 76.2, 62.7, 64.2 and 90% for the fresh forage yield. The corresponding increase of the dry forage yield reached 93.2, 61.9, 60.8, and 104% with application the high rate humic acid (4 ml/L) in 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and the 4<sup>th</sup> cuts, respectively. Which, the highest mean values were 11.41 and 1.932 (ton / fed) with 3<sup>rd</sup> cut for fresh and dry forage yields.

Furthermore, the highest mean values of the accumulative fresh and dry forage yields were 39.83 and 6.84 (ton /fed), and the highest percentage increase were 72.3 and 72.3% with spraying the highest rate of humic acid ( 4 ml / l ) compared with control treatment. This increase may due to the role of humic acid which play a prominent role in various physiological and biochemical processes related to environmental stresses. Humic acid have ecological importance, as they intervene in the regulation of a large number of chemical and biological processes that occur in the natural ecosystems **Chen et al., (2004)**. **Ghorbani et al., (2010)** reported that foliar spraying with humic acid has remarkable effects on vegetative growth of plant and increases photosynthetic activity and leaf area. **El-Nemr et al., (2012)** found that spraying HA and bio-stimulators through foliar application led to a positive effect on plant growth.

Moreover, it is obviously showed that increasing application of the mixture amino acids increased significantly the fresh and dry forage yields through the taken four cuts and the accumulative yields. The increases reached about 73.1 , 53.7 , 52.9 and 77.7 % for fresh yield ,while being 78.4 , 55.9, 80.8 and 85.9 % for the dry forage yields with spraying the highest rate amino acid mixture ( 4 ml /L ) for 1<sup>st</sup> , 2<sup>nd</sup> , 3<sup>rd</sup> and the 4<sup>th</sup> cuts, respectively. The highest mean values were 10.63 and 1.89 ton / fed were obtained at the 3<sup>rd</sup> cut for fresh and of dry forage yields, while, the lowest mean values were 6.42 , 1.14 (ton /fed) for fresh and dry forage yields were obtained with the 4<sup>th</sup> cut .Generally, the highest mean values of the accumulative fresh and dry forage yields were 37.46 and 6.63 (ton /fed), and the percentage increase reached by about 62 and 67 % with spraying the high level mixture amino acid (4 ml / l ) compared with control treatment. This increase of fresh and dry yields (Egyptian clover) can directly or indirectly influences the physiological activities in plant growth and development. Many studies reported that, the foliar application of amino acids caused an enhancement in plant growth, fruits yield and its components, on cucumber **Karuppaiah et al., (2000)**, **El-Shabasi (2005)**.on garlic and **Awad et al., (2007)** on potato. **Perez et al. (2015)**, mentioned that the amino acids activates plant synthesis efficiency and internal immunity in addition to improves the qualities of growth and yield.

For the double interaction (Y×H), (Y ×A) and (H ×A) they increased significantly the fresh and the dry yields of Egyptian clover through the studied four cuts and the accumulative yield. The spraying with the higher rates of both humic and the mixture of amino acids (4 ml/



L) with high rate of yeast (4g /L) indicated the higher significantly of fresh, dry and the accumulative yields represent. Where the highest increase of the accumulative fresh and dry yields were with interaction (Y ×H).

Respective the triple interaction among the studied treatments (Y×H×A) data indicated significant positive effect on the fresh yields for the four cuts and the accumulative of them. Where spraying plants with the higher rates 4 ml/L of both humic & amino acids and 4 g/L of dry yeast ) showed the higher fresh , dry yields for each cut and the accumulative yield . The increases reached about 114, 96.5, 92.4 and 127 % for the four fresh cuts and 125, 100, 104 and 143.7% for the four dry cuts yields compared to control treatment. Where the increases of accumulative yield reached about 102.9 and 114 % for fresh and dry yields. As mentioned before the higher yields were found in the 2<sup>nd</sup> cut and the 3<sup>rd</sup> cut, while the lowest was found in the 4<sup>th</sup> cut.

#### **Effect of the applied treatments on N and protein content:**

Data in Table (5) and figs (1 and 2) indicated that increasing rate of yeast application increased N concentration, protein percentage and significantly N uptake. The highest percentage increases reached about 99.8 , 69.7, 73.8 and 121.7 % for N uptake & 8.2 , 9.39 , 10.6 and 9.8% , for protein due to the studied four cuts and 87.5% for the accumulative N uptake at all season , respectively with higher application rate of yeast compared to control .

Regarding the foliar application with humic acid, data showed that increasing rate of humic acid application increased N concentration, protein percentage and significantly N uptake. The increases of N uptake reached about 108, 84.6, 76.4 and 130 % & 3.5, 6.9, 9.5 and 11.9% for protein content by studied four cuts, respectively while being 99% for the accumulative N uptake at the whole season, respectively with application the high rate of humic acid (4ml / L) compared with control treatment.

It is obviously, increasing application rate of amino acid increased N concentration, protein and significantly N uptake for the studied four cuts and the accumulative. The increases of N uptake reached about 90.4, 70, 73.4 and 108.5% while being 7.5, 8.5, 9.5 and 11.8% for protein content through the studied four cuts, respectively and 83 % for the accumulative N uptake.

Respecting the double interactions (Y×H), (Y ×A) and (H ×A) they increased of both N concentration & protein content and significantly the

N uptake through studied four cuts where (y × H) showed the highest values of the studied parameters.

For the effect of triple interaction among the studied treatments (Y×H×A) data indicated increases of both N concentration & protein content and significantly the N uptake through the studied four cuts. Foliar application by the higher rate of yeast ( 4 g/L ), humic and amino acids ( 4 ml / L ) indicated increases reached about 159.6 , 136.6, 141 and 189% for N uptake & 15.4 , 18 , 18.2 and 18.6% for protein content through the studied four cuts, respectively awhile being 152% for the accumulative N uptake at whole cuts of the season.

**Table (5). Effect of the studied treatments on N uptake (kg /fed) and protein content (%) of dry s Egyptian clovers hoot through the four cuts.**

Yeast g/l Y	Humic Acid ml / l H	Amino Acid ml / l A	N uptake ( kg /fed)				Total Accu	Protein (%)				
			1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
0	0	0	13.4	18.07	18.49	10.33	60.29	9.50	9.58	9.63	9.13	
		2	15.08	20.08	20.79	13.09	69.04	9.54	9.63	9.67	9.21	
		4	17.45	22.54	23.34	13.92	77.25	9.63	9.71	9.83	9.29	
	2	0	18.01	20.29	20.93	14.55	73.78	9.58	9.71	9.75	9.67	
		2	18.68	25.17	26.4	15.07	85.32	9.71	9.83	10.00	9.79	
		4	22.32	25.32	27.35	18.16	93.15	9.75	10.00	10.08	9.92	
	4	0	19.74	22.98	23.72	15.86	82.3	9.79	9.83	9.88	9.79	
		2	21.54	29	28.71	17.31	96.56	9.92	10.04	10.21	10.00	
		4	23.33	31.34	32.65	18.43	105.75	10.04	10.17	10.33	10.00	
	2	0	0	16.09	19.08	19.42	13.78	68.37	9.75	9.79	9.83	9.71
			2	18.03	21.54	22.46	16.73	78.76	9.83	9.88	10.00	9.88
			4	21.39	24.88	25.67	17.64	89.58	10.00	10.08	10.13	10.08
2		0	23.73	26.51	27.3	20.38	97.92	9.88	9.92	9.96	9.79	
		2	25.6	30.49	31.83	21.76	109.68	10.04	10.21	10.42	10.00	
		4	26.94	32.49	33.83	24.24	117.5	10.29	10.50	10.63	10.13	
4		0	27.93	31.06	31.07	24.23	114.29	10.00	10.08	10.17	10.08	
		2	30.75	35.77	37.65	27.52	131.69	10.25	10.46	10.67	10.21	
		4	32.52	38.16	39.42	28.41	138.51	10.42	10.75	10.96	10.50	
4		0	0	17.81	19.6	20.52	15.47	73.4	9.88	9.96	10.08	9.83
			2	21.54	23.41	24.36	17.67	86.98	10.00	10.25	10.42	10.08
			4	22.09	26.13	27.74	18.8	94.76	10.21	10.42	10.67	10.42
	2	0	25.42	28.26	28.82	21.76	104.26	10.00	10.08	10.17	10.08	
		2	28.85	33.04	34.69	24.48	121.06	10.25	10.50	10.83	10.38	
		4	30.25	34.5	35.85	25.75	126.35	10.46	10.71	10.96	10.75	
	4	0	28.67	30.72	32.39	25.03	116.81	10.13	10.25	10.42	10.17	
		2	32.57	39.4	42.06	28	142.03	10.67	10.88	10.96	10.42	
		4	34.78	42.76	44.6	29.92	152.06	10.96	11.31	11.38	10.83	
	<b>LSD at 0.05</b>											
	Y			0.05	0.08	0.42	0.04					
	H			0.59	0.60	0.98	0.53					
A			0.16	0.19	0.56	0.14						
Y × H			0.08	0.09	0.73	0.07						
Y × A			0.08	0.09	0.73	0.07						
H × A			0.27	0.28	0.96	0.24						
Y × H × A			0.14	0.15	0.22	0.12						

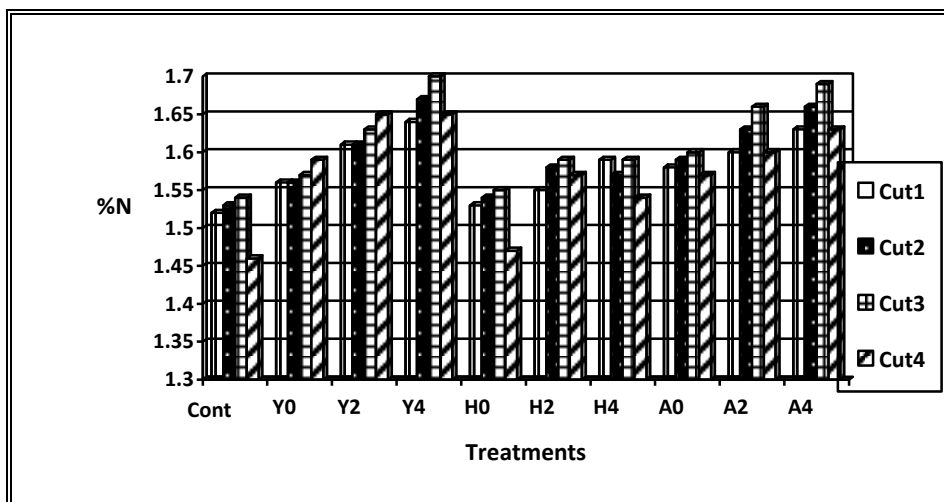


Fig (1). Effect of the studied treatments on N% of Egyptian clover through four cuts.

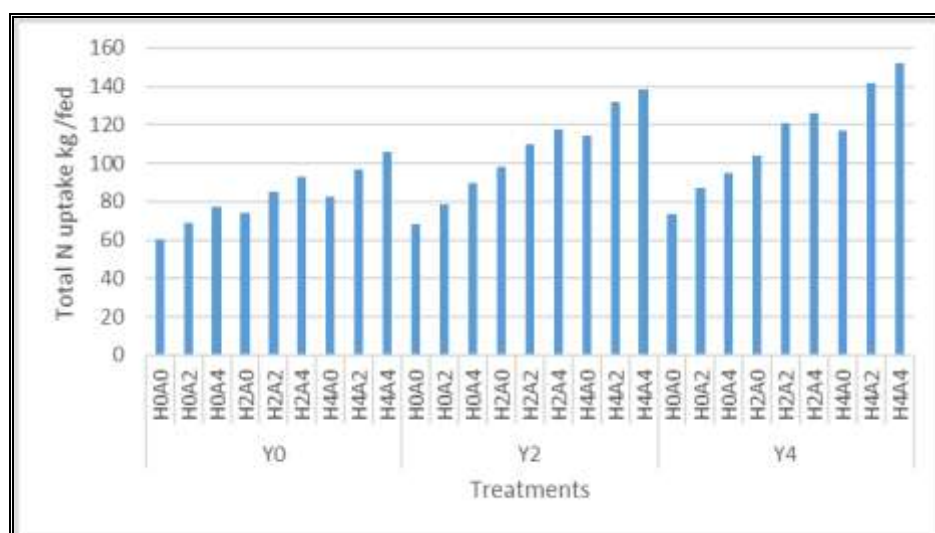


Fig (2) .Effect of the studied treatments on the accumulative N uptake at whole season (kg/fed.).

**Effect of the applied treatments on P content:**

Data in Table (6) and figs (3 and 4) indicated that increasing rate of yeast application increased P concentration and significantly P uptake. The highest percentage increases reached about 151, 121, 130 and 166 % for P uptake by studied four cuts and 144% for the accumulative P uptake at whole season, respectively with higher application rate of yeast compared with control treatment.

Regarding the foliar application with humic acid, data showed that increasing rate of humic acid application increased P concentration, and significantly N uptake. The increases of P uptake reached about 162, 140, 143 and 177 % due to the studied four cuts, respectively and 160% for accumulative P uptake at whole season, respectively with higher application rate of humic acid (4 ml / L) compared with control treatment.

Increasing application rate of amino acid increased P concentration and significantly P uptake for the studied four cuts and the accumulative. The increases of P uptake reached about 133, 132, 121 and 145% through the studied four cuts, respectively and 132 % for the accumulative P uptake.

Respecting the double interaction (Y×H), (Y ×A) and (H ×A) they increased of both P concentration and significantly the P uptake through studied four cuts. Where the interaction between (y × H) showed the higher increase of both P concentration and uptake.

For the effect of triple interaction among the studied treatments (Y×H×A) data indicated that increases of both P concentration and significantly the P uptake through the studied four cuts. Foliar application by the higher rate of yeast ( 4g/L) , humic and amino acids ( 4ml / L ) indicated increases reached to about 271, 240 , 264 and 298% for P uptake through the studied four cuts, respectively and 264% for P accumulative uptake at whole season .

#### **Effect of the applied treatments on K content:**

Data in Table (6) and figs (5 and 6) indicated that increasing rate application of yeast increased K concentration and significantly K uptake. The highest percentage increases reached about 189 , 147, 85 and 131 % for K uptake by studied four cuts and 113% for the accumulative K uptake at whole season, respectively with application the higher rate of yeast ( 4g / L ) compared to control.

It is noticed that, increasing rate of humic acid application increased K concentration, and significantly K uptake. The increases of K uptake reached by about 162.6, 140.6, 142.7 and 177 % due to the studied four cuts, respectively and 160% for the accumulative P uptake at whole season, respectively with higher application rate of humic acid (4 ml / L) compared with control treatment.

Increasing application rate of amino acid increased K concentration and significantly K uptake for the studied four cuts and the accumulative K uptake. The increases of K uptake reached to about 133, 131.7, 121 and 145% through the studied four cuts, respectively and 132 % for the accumulative K uptake.

Respecting the double interaction (Y×H), (Y ×A) and (H ×A) they increased of both K concentration and significantly the K uptake through

studied four cuts. The interaction (Y×H) showed the highest values of K concentration and uptake.

For the effect of the triple interaction among the studied treatments (Y×H×A), data indicated increases of both K concentration and significantly the K uptake through studied four cuts. Application the higher rate of yeast ( 4 g/L ) , humic and amino acids ( 4 ml / L ) indicated increases reached to about 271 , 240 , 264 and 298% for k uptake through the studied four cuts, respectively and 264% for the accumulative K uptake at whole season .

**Table (6). Effect of the studied treatments on P and K uptake (kg /fed) of dry shoot Egyptian clover through four cuts.**

Yeast g / l Y	Humic Acid ml / l H	Amino Acid ml / l A	P uptake ( kg /fed)				Total Accu	K uptake (kg /fed)				Total Accu	
			1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>		
0	0	0	2.03	2.71	2.76	1.56	9.06	2.85	3.84	5.32	3.18	15.19	
		2	2.27	3.00	3.09	1.87	10.23	3.29	4.41	6.32	4.24	18.26	
		4	2.61	3.34	3.56	2.06	11.57	3.83	5.02	7.08	4.56	20.49	
	2	0	2.82	3.13	3.22	2.16	11.33	3.91	4.41	6.26	4.58	19.16	
		2	3.13	4.16	4.45	2.4	14.14	4.16	5.65	7.97	4.81	22.59	
		4	3.86	4.43	4.75	3.09	16.13	5.05	5.67	8.36	6.03	25.11	
	4	0	3.28	3.8	4.05	2.53	13.66	4.3	5.06	7.21	5.16	21.73	
		2	3.8	5.05	5.27	2.92	17.04	4.89	6.64	8.79	5.92	26.24	
		4	4.06	5.59	5.93	3.11	18.69	5.41	7.28	10.21	6.65	29.55	
	2	0	0	2.48	3.04	3.09	2.04	10.65	4.57	5.44	5.59	4.05	19.65
			2	2.86	3.54	3.79	2.65	12.84	5.35	6.5	6.88	5.11	23.84
			4	3.48	4.16	4.28	2.73	14.65	6.42	7.56	7.92	5.5	27.4
2		0	3.91	4.51	4.63	3.25	16.3	6.86	7.8	8.1	6.76	29.52	
		2	4.78	5.97	6.3	3.94	20.99	7.85	9.39	9.87	6.94	34.05	
		4	5.23	6.38	6.57	4.64	22.82	8.34	10.06	10.49	8.03	36.92	
4		0	4.71	5.39	5.54	3.61	19.25	8.2	9.19	9.22	7.81	34.42	
		2	6.19	7.7	8.38	5.39	27.66	9.75	11.27	11.85	9.39	42.26	
		4	6.83	8.43	8.77	5.58	29.61	10.59	12.2	12.43	9.81	45.03	
4		0	0	2.93	3.32	3.44	2.46	12.15	5.07	5.62	5.94	4.59	21.22
			2	3.5	3.85	4.09	2.74	14.18	6.42	6.89	7.31	5.55	26.17
			4	3.79	4.39	4.71	2.93	15.82	6.59	7.89	8.29	5.79	28.56
	2	0	4.29	5.43	5.67	3.64	19.03	7.74	9.11	8.86	7.24	32.95	
		2	6.16	6.88	7.21	4.87	25.12	8.8	10.03	10.35	7.96	37.14	
		4	6.33	7.65	7.77	5.09	26.84	9.53	10.81	11.1	8.19	39.63	
	4	0	5.49	5.99	6.22	4.46	22.16	9.03	9.74	10.3	8.31	37.38	
		2	6.87	8.61	9.6	5.88	30.96	10.44	12.61	13.44	9.52	46.01	
		4	7.54	9.21	10.05	6.22	33.02	11.45	13.7	14.21	9.79	49.15	
	LSD at 0.05												
	Y			0.01	0.02	0.08	0.03		0.02	0.03	0.12	0.01	
	H			0.11	0.12	0.18	0.09		0.17	0.18	0.30	0.17	
A			0.03	0.35	0.11	0.04		0.05	0.06	0.17	0.04		
Y × H			0.02	0.06	0.14	0.02		0.08	0.03	0.22	0.02		
Y × A			0.02	0.02	0.14	0.02		0.03	0.03	0.22	0.02		
H × A			0.06	0.02	0.18	0.05		0.01	0.08	0.29	0.08		
Y × H × A			0.03	0.04	0.23	0.03		0.04	0.05	0.23	0.04		

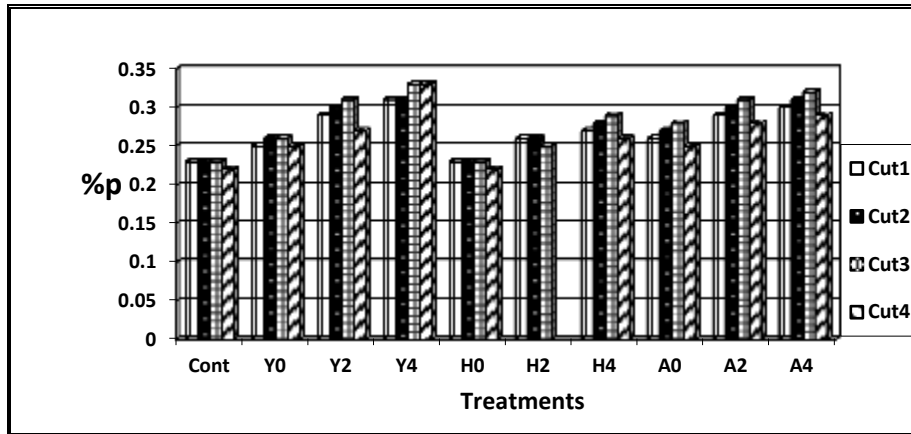


Fig (3) .Effect of the studied treatments on % of Egyptian clover through four cuts

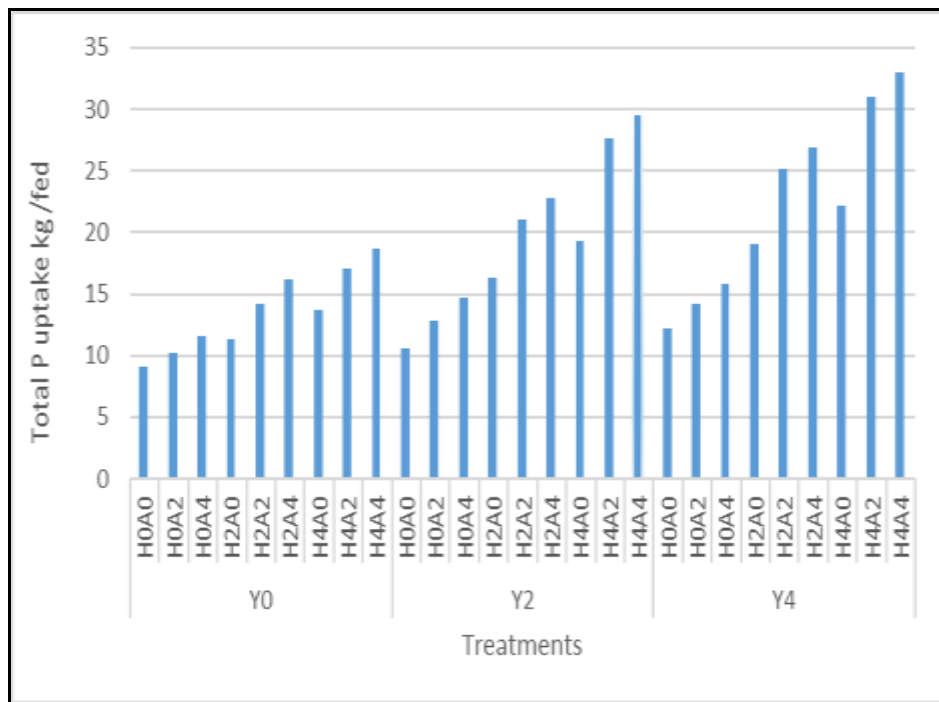


Fig (4) .Effect of the studied treatments on the accumulative P uptake at whole season (kg/fed.).

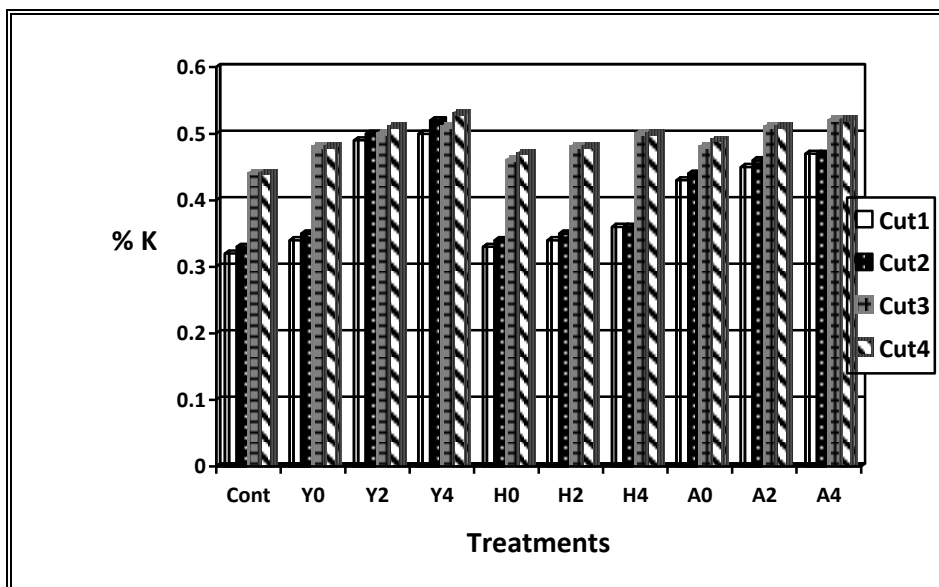


Fig (5) .Effect of the studied treatments on K% of Egyptian clover through four cuts.

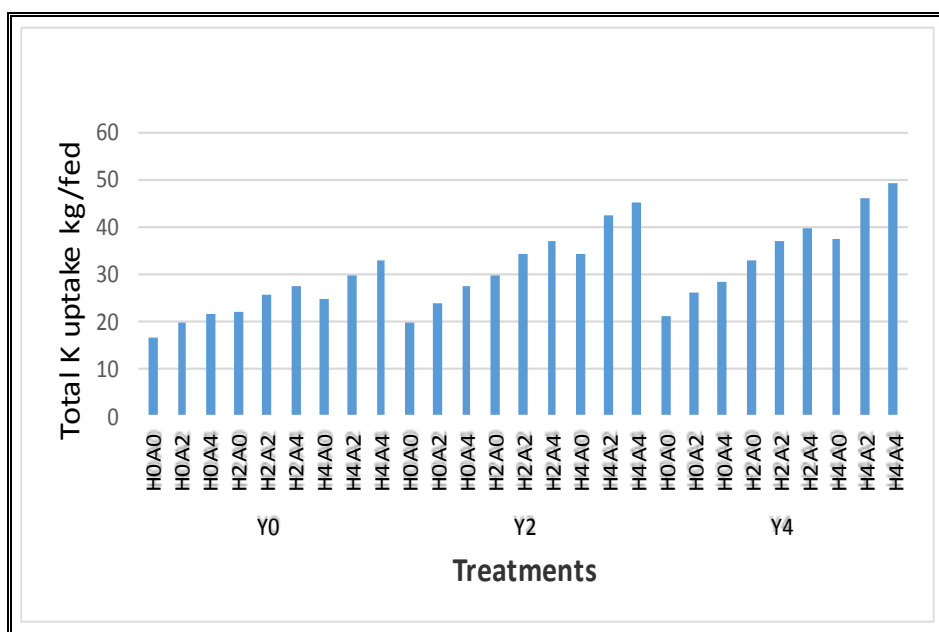


Fig (6). Effect of the studied treatments on accumulative K uptake at whole season (kg/fed.).

The increases of concentration and uptake of nutrients studied may be due to role the natural applied growth promoters as active dry yeast , humic and amino acids even, individually or together as double or triple applications have benefit effects and their role in the activation of all vital processes which affect and improving the plant growth ( Egyptian clover ) throughout the studied 4 cuts, as well as encourage the absorption of some essential nutrients such as (N, P and K) from soil and by then increased their concentrations and uptakes these results agreed with many investigators ,likewise , **El-Nemer, (2012 )** , **El –Hefny (2010)** , **Sultan et al., ( 2016 )** , **Abosedra et al., ( 2010)** . and **Hafez et al., ( 2020 )**

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### تأثير الرش بتركيزات مختلفة من المحفزات الحيوية على

### البرسيم المصرى فى أرض جيرية .

فتحي عبد الفتاح العزيزى

قسم خصوبة وميكروبيولوجيا الاراضى - مركز بحوث الصحراء .

أقيمت تجربة حقلية خلال الموسم الشتوى 2018 / 2019 على محصول البرسيم المصرى النامى فى أرض جيرية تحت نظام الرى السطحى بمحطة بحوث مريوط التابعة لمركز بحوث الصحراء لدراسة تأثير الرش بالخميرة الجافة النشطة بمعدل ( صفر و 2 و 4 جرام / لتر) والرش بحمض الهيوميك بمعدل ( صفر و 2 و 4 مل / لتر) والرش بمحلول الاحماض الامينية بمعدل ( صفر و 2 و 4 مل / لتر) سواء بصورة منفردة أو مجتمعة وتم الرش على أربعة

دفعات حيث كانت الرشة الاولى بعد 25 يوم من الزراعة والرشة الثانية والثالثة والرابعة بعد 10 أيام من كل حشة وحيث وضعت معاملات الرش بالخميرة الجافة فى القطع الرئيسية و الرش ب حمض الهيوميك فى القطع الشقية ومعاملات الرش بمخلوط الاحماض الامينية فى القطع تحت الشقية .

**وقد أظهرت النتائج ما يلى :**

- يوجد تأثير معنوى للمعاملات تحت الدراسة سواء الرش بالخميرة الجافة أو حمض الهيوميك أو الرش بالاحماض الامينية منفردة أو مجتمعة على محصول العلف الطازج أو الجاف وكذلك على التركيز والممتص من عناصر النتروجين والفسفور والبوتاسيوم .
- اضافة الخميرة الجافة بالرش بمعدل 4 جرام / لتر مع حمض الهيوميك بمعدل 4 مل / لتر مع مخلوط الاحماض الامينية بمعدل 4 مل / لتر رشا أعطت أحسن النتائج وأعلى محصول من العلف الاخضر (46.88 طن / فدان) و (8.52 طن / فدان) لمحصول العلف الجاف خلال الموسم على الترتيب .
- أعطت أيضا أعلى قيم للبروتين (%) وكانت 15.4 و 18 و 18.2 و 18.6 % فى الحشة الاولى والثانية والثالثة والرابعة على الترتيب بالمقارنة بالمعاملات الاخرى - وكذلك أعطت أعلى قيم للتركيز والممتص من عناصر النتروجين والفسفور والبوتاسيوم تحت الدراسة فى العلف الجاف .