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The effect of foliar application of the bio-stimulant “Felloton” on growth and yield of wheat.

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Abstract. A field experiment was carried out to study the effect of spraying a sea weed extract with different concentration on growth and yield of two wheat cultivars (Barcelona and IPA99). The planets were fertilized with 40Kg N + 40Kg P hectare⁻¹ as basal application. At the jointing stage the nutritional extract was sprayed with the following concentrations (control, 200 ml, 300 ml, 400 ml, 500 ml/ 100 liter of water). The experiment laid out was in split- plot RCBD. The concentrations occupied the main plots and, the varieties had the sub-plots with three replicates. Results showed that Barcelona variety out yielded IPA cultivar on the over whole studied traits (plant height, leaf number, flag leaf area, plant dry weight, spike length, number of seed/spikes, weight of 100 grain, grain, and straw yield. The concentration 300 ml/ 100 liter of water gave the highest means. There was no significant difference between control with 200 ml/ 100 liter of water and 400 ml with 500 ml/ 100 liter of water in planet height, number of leaves, planer dry weight, spike length, number of seeds/ spikes, weight of 100 grain, grain, and straw yield. Barcelona variety gave 5.16 ton of seed yield compared with 4.83 Ton hectare⁻¹ for 1PA cultivar. The interaction between Barcelona and 300 ml/100 liter of water gave the best results.

1. Introduction

Wheat considers as the most important field crops on world where it gives energy for the human needs. The focus on mechanization, fertilization, pests' control might help in increasing productivity. The foliar nutrition had a major role in improving growth and productivity because it gives the remedy for the nutrients deficiency in particular those which are subjected to leaching and fixing in soil (3). The old varieties (Abu Gariab and Maxipac) still in practice despite their susceptibility to loading and disease infection. Thus, it is necessary to produce new cultivars which are fit to the environment then eventually increase the grain yield (8). In case of the variance between the varieties, (8) found the variety IPA was superior in flag leaf area, but didn't significantly differ from Tamoz 3, Tamoz 2 and Tahadey. Also, (4) found significant difference between wheat cultivars in number of grain/ spikes where the variety Tamoz 2 was the best. While, (17) found significant difference between their races in 1000 grain weight where the race Florence was superior. While, (9) found difference between seven races in grain yield where the variety ditic 62 gave 5.4-ton hectare⁻¹. In contrast the variety park produced 3.5-ton hectare⁻¹ because of that the specialists started to find the best ways to raise crop productivity. One of those ways was the use



of mineral nutrition because it had a major role in improving growth and yield (7). The studying tackles the nutritional balance problem between the major and trace elements inside the plant, but the researchers have concentrated to handle them individually and didn't include the method of application in particular the spray and basal application (3). The sea weed extracts considers as on of the bio- technology which effects crop productivity, quantity, and quality of the yield (14). It contains a growth hormone, amino acids which influences the bio activity inside the plant (19). It plays also an important role in growth improvement and increase flowering rate because it contains on nutritional elements, vitamins, proteins, amino acids, polysaccharides, and growth exhibitors (5). It plays an important role in increasing plant tolerant to different stresses, because it contains a high percent of salicylic acid, cytokines, growth hormones, and humic acid which improves root growth and increase photosynthesis efficiency (11). The area studying's on the effect of bio- stimulants (The Sea Algae) on growth and yield of wheat. This study being carried out and the extract "ASEO PHYLLUM NODOSUM- FELLOTON". It had special components from amino acids mixed with sea algae extracts activated with exhibitors and growth hormones (company recommendation).

2. Materials and Methods

A field experiment was carried out during the growing season of 2017-2018 in Mussyab, Which is located 3 Km from technical college. (Table, 1) summarizes the physical and chemical properties of the experiment soil to study the effect of foliar application of the above extract (felloton) on growth and yield of two wheat varieties (IPA99 and Barcelona).

Table 1. Some physical and chemical properties of experimental soil

Characters	Values
Sand %	37.8
Silt %	42.9
Clay %	19.3
Soil texture	Silty loam
Electric conductivity (EC)	4.98 DMS/m
pH	7.9
No3 ppm	81.9
P ppm	21.0
Organic matter %	1.9

The supplies were bought from Agricultural Bureaus that get the supplies from the Ministry of Agriculture. The soil plowed twice vertically and fertilized with the first dose 20 Kg N/ ha from urea fertilizer (46% N) with 40 Kg P/ ha from DAP (46% P) (17). After which the soil diced , harrowed and divided into plots (20 * 4 M). The experimental units arranged in splits – plot design where the extract concentrations occupied the main plot. The varieties had the sub-plots with three replicates. The seeds sown on the 15th of November at a seeding rate of 100 kg/ ha in rows 15 cm apart (4). At the jointing stage the plants were sprayed with felloton which contains organic nitrogen (N) 8%, organic carbon (C) 25%, and organic sterilized matters 35%. With different concentrations of control, river water, 200 ml/ 100 liter of water, 300 ml/ 100 liter of water, 400 ml/ 100 liter of water, and 500 ml/ 100 liter of water. The manufacturing company recommendation was 250-350 ml/ 100 liter of water. The spraying was in portable sprayer during the sunset. A washing detergent was added of a rate of 15 gm/ 100 liter of water to increase spraying solution efficiency and help in wetting the plant canopy. At the heading stage 10 plants were sampled from each experimental unit. 20 Kg N/ha was added, and the following measurements were taken.

- a. Planet height (cm) from the soil surface to the last node.
- b. Number of leaves.
- c. Flag leaf area following the equation “leaf length * maximum width * 0.95 (10)”.
- d. Plant dry weight (gm), the plants were dried inside oven at 70 °C for three days.

During the seed ripening stage (Dough), one meter from each experimental unit was harvested, 10 plants were sub- sampled to determine

1. Spike length
2. Number of seeds/spikes
3. Weight of 100 grain
4. Total grain weight and straw yield.

The results subjected to statistical analysis. The means were compared (20) by using leaf significant means (L.S.D) at a probability level of 5%.

3. Results and Discussion

There was significant effects of concentration and variety on planet height trait (Table, 2).

Table 2. Effect of spraying at different concentration levels of the extract Felloton on plant height (Cm) for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	88.5	93.4	90.9
200ml/100 liter of water	95.8	93.1	94.5
300ml/100 liter of water	107.9	97.3	102.6
400ml/100 liter of water	100.2	95.5	97.9
500ml/100 liter of water	100.1	96.4	98.3
Mean	98.5	95.1	
L.S.D at 5% prob. level	Varieties 2.346	Conc. Levels 3.709	Interaction 5.245

The concentration 300 ml/100 liter of water achieved the heights value (102.6 cm) followed by the level 500 ml/100 liter of water gave the value of (98.3 cm). There was no significant difference between the control and 200 ml/100 liter of water. The variety Barcelona was superior. It achieved 98.5 cm compared with 95.1 cm for IPA99. This was due to the heredity difference between the two varieties. This being supported by many workers (8). The reason for the difference between control and spraying treatments because the solution contained an organic nitrogen which help in increasing amino acid level inside the cell. Also, produce proteins which enhance cell division and cell expansion which will result in plant height increasing (1).

The influence of the two factors persisted with leaf number. The concentration 300 ml/100 liter of water gave 7.6 leaf (Table, 3).

Table 3. Effect of spraying at different concentration levels of the extract Felloton on leaf number for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	6.4	6.2	6.3
200ml/100 liter of water	6.8	6.6	6.7
300ml/100 liter of water	8.2	6.9	7.6
400ml/100 liter of water	6.8	6.3	6.6
500ml/100 liter of water	6.6	6.3	6.5
Mean	6.9	6.5	
L.S.d at 5% prob. level	Varieties ns	Conce. Levels 0.757	Interaction ns

There was no significant difference between the control with concentration 200 ml/100 liter of water and 400 ml and 500 ml /100 liter of water levels. In contrast, there was no significant difference between the varieties. The reason for increasing leaf numbers with the increase in spraying level compared with control treatment, the bio stimulant enhances root growth which exceeded the nutrients uptake then eventually vegetative growth (12).

Table 4. Effect of spraying at different concentration levels of the extract Felloton on flag leaf area (Cm²/plant) for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	27.9	27.1	27.5
200ml/100 liter of water	38.9	31.2	35.1
300ml/100 liter of water	44.2	38.3	41.3
400ml/100 liter of water	38.7	36.6	37.7
500ml/100 liter of water	34.3	32.2	33.3
Mean	36.8	33.1	
L.S.d at 5% prob. level	Varieties 3.532	Conce. Levels 5.584	Interaction 7.897

The level 300 ml /100 liter of water achieved the heights mean (41.3 cm/plant), which had no significant difference with 400 ml. The extract contains organic nitrogen and amino acids which exceeded plant growth through the enhancement of cell division and enlarging which leads to increasing the leaf area (2). The variety Barcelona achieved a leaf area of 36.8 cm²/plant compared with 33.1 cm²/plant for IPA. It is noticeable that the variety IPA gave a leaf are less than that found by (8).

The spraying level of 300 ml /100 liter of water had a significant increase in plant dry weight (2.85 gm/plant). There was no significant difference between control with 200 ml , 400 ml and 500 ml (Table, 5).

Table 5. Effect of spraying at different concentration levels of the extract Felloton on plant dry weight (gm/plant) for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	2.27	2.10	2.18
200ml/100 liter of water	2.33	2.33	2.33
300ml/100 liter of water	3.27	2.43	2.85
400ml/100 liter of water	2.50	2.23	2.37
500ml/100 liter of water	2.54	2.23	2.39
Mean	2.58	2.27	
L.S.d at 5% prob. level	Varieties 0.265	Conce. Levels 0.419	Interaction 0.592

The increase in the leaf numbers and leaf rea significantly affected the plant vegetative growth and then plant dry weight. The sea algae extract contains organic nitrogen and carbon which are very important in chlorophyll molecule initiation which helps in increasing photosynthesis process then as a result exceeded the vegetative growth (13). The variety Barcelona was superior in dry weight compared with IPA (2.58 and 2.27 gm/ plant) respectively.

The effect of extract persisted on its effect on yield and its component. The spraying level 300 ml /100 liter of water had the heights spike length (10.88 cm), (Table ,6).

Table 6. Effect of spraying at different concentration levels of the extract Felloton on spike length (Cm) for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	9.53	8.80	9.17
200ml/100 liter of water	10.23	9.77	10.00
300ml/100 liter of water	12.20	9.57	10.88
400ml/100 liter of water	9.97	9.77	9.87
500ml/100 liter of water	9.93	9.47	9.70
Mean	10.37	9.47	
L.S.d at 5% prob. level	Varieties 0.540	Conce. Levels 0.853	Interaction 1.207

There was no significant difference between the control with 200 ml, 400 ml, and 500 ml. The variety Barcelona gave superior spike length 10.37 cm compared with 9.47 cm for IPA.

The same response was found with number of seeds/spikes (Table, 7).

Table 7. Effect of spraying at different concentration levels of the extract Felloton on number of seeds/spikes for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	57.00	54.70	55.85
200ml/100 liter of water	62.07	53.90	57.98
300ml/100 liter of water	89.53	75.33	82.43
400ml/100 liter of water	70.37	64.00	67.18
500ml/100 liter of water	67.67	64.90	66.23
Mean	69.33	62.57	
L.S.d at 5% prob. level	Varieties 2.432	Conce. Levels 3.846	Interaction 5.439

Where the spraying level 300 ml /100 liter of water gave the heights number (82.43). There was no significant difference between control with 200 ml conc./100 liter of water and 400 ml with 500 ml /100 liter of water. That is attributed to the increase in vegetative growth which leads to increase the assimilates inside their sources and the rapid importance toward the sinks (spikes). On the other hand, the availability of assimilates reduced the competition between the seeds (18). But that effect didn't persist under the higher concentrations level which meant that despite the privilege of the feeding operation, throughout the spraying, there were several warrants one of them is the limitation of the exact spraying. Where the range could be narrowed between optimal and toxicity (16). That led the optimal level in this study was at the second concentration 300 ml. The unbalance between the plant hormones at 400 ml and 500 ml led to the scarcity of the significance or the supplementary spraying with mineral elements didn't give that much influence (21).

The concentration 300 ml gave the heights means of 100 seeds weight (8.54 gm). There was no significant difference between the control with 200 , 400 and 500 ml (Table, 8).

Table 8. Effect of spraying at different concentration levels of the extract Felloton on 100 grain weight (gm) for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	6.60	6.53	6.57
200ml/100 liter of water	8.47	6.10	7.23
300ml/100 liter of water	9.57	7.33	8.45
400ml/100 liter of water	8.40	6.73	7.57
500ml/100 liter of water	7.87	5.90	6.88
Mean	8.18	6.52	
L.S.d at 5% prob. level	Varieties 0.451	Conce. Levels 0.713	Interaction 1.009

That was due to the extract's role in increasing permeability of the root cell membranes which increase the nutrients uptake then exceeded the assimilates throughout the photosynthesis and transport them to the sinks (18).

The variety Barcelona out yielded the variety IPA on all studied yield components. That led to the increase in grain yield. The variety Barcelona gave 5.16 ton/ha compared with 4.83 ton/ha for IPA (Table,9).

Table 9. Effect of spraying at different concentration levels of the extract Felloton on grain yield (ton/ ha) for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	4.67	4.53	4.60
200ml/100 liter of water	5.07	4.84	4.96
300ml/100 liter of water	5.59	5.21	5.40
400ml/100 liter of water	5.13	4.90	5.02
500ml/100 liter of water	5.33	4.69	5.01
Mean	5.16	4.83	
L.S.d at 5% prob. level	Varieties 0.211	Conce. Levels 0.331	Interaction 0.473

The second concentration 300 ml gave the heights grain yield of 5.4 ton/ha. There was no significant difference between the concentrations 400 ml and 500 ml. That is because the extract contains several amino acids and mineral elements which effect the bio activity inside the plant throughout increasing of the chlorophyll molecules (5). Also, the extract comprises the organic carbon which increased photosynthesis efficiency (19,11). It gave high rate of assimilates which reduced the apportion state between the florets throughout reducing the competition of food assimilates (6).

The increasing in plant height, flag leaf area, and overall vegetative growth led to increase in straw yield (Table, 10).

Table 10. Effect of spraying at different concentration levels of the extract Felloton on straw yield (ton/ha) for two wheat varieties.

Varieties	Barcelona	IPA99	Mean
Conc. levels			
Control	4.10	4.23	4.17
200ml/100 liter of water	4.90	4.30	4.60
300ml/100 liter of water	6.37	4.63	5.50
400ml/100 liter of water	4.50	4.70	4.60
500ml/100 liter of water	4.20	4.27	4.23
Mean	4.81	4.43	
L.S.d at 5% prob. level	Varieties 0.363	Conce. Levels 0.574	Interaction 0.812

The concertation 300 ml had 5.50 ton/ha. There was no significant difference between the control with 200 ml level and 400 ml with 500 ml. The variety Barcelona gave higher grain and straw yield compared with IPA. The grain yield in this study equalized the grain yield of other varieties (SABAH) cropped at the same location. It could be concluded that the bio-stimulant had some influence on crop yield (14). The interaction between variety Barcelona and 300 ml concentration gave the best results on overall studied traits.

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