RESULTS AND DISCUSSION

I. Wheat response to soil application of nitrogen:

Growth characters, grain yield and yield components as well as chemical composition of grain and straw in 1995 / 96 and 1997 / 98 seasons, are shown in Tables (3, 4 and 5).

I.1. Growth characters:

Results for the effect of nitrogen level on growth characters of wheat; namely, plant height, number of leaves / stalk, flag leaf area, number of stalks/m^2 and dry weights of different plant organs at 90 days from planting in 1995 /96 and 1997 /98 seasons are shown in Table (3).

I.1.a. Plant height:

Application 25, 50, 75 and 100 Kg N/fad led increase to plant height over the check treatment by 4.8, 5.8, 6.7 and 5.8% in 1995/96 season and by 7.3, 8.3, 8.3 and 7.3% in 1997 / 98 season, respectively. Differences among 25, 50, 75 and 100 kg N /fad levels were not significant. These results may be explained on the basis that N is essential for building up protoplasm and amino acids which induce cell division and increase meristematic activity. These results agree with those obtained by ***Morsy (1993), Zahran and Mosalem (1993) and Salwau (1994)*** who recorded that N fertilizer level significantly increased plant height. However, the differences among 30, 45, 60 and 75 Kg /fad were not significant.

I.1.b. Number of leaves / stalk:

Data recorded in Table (3) clearly indicate the significant differences among the mean values of number of leaves / stalk by adding

Table (3): Vegetative growth characters of wheat plant at 90 days from planting as affected by N rates in 1995 / 96 and 1997/98 seasons.

Growth characters / N-levles (kg/fad)	Plant height (cm)	No. Leaves stalk	Flag leaf area (cm^2)	No. of Stalks /m^2.	Dry weight (g) of Stem	Dry weight (g) of leaves	Dry weight (g) of Spike	Total Plant
1995/96 season								
0	104 b	3.3 b	24.7 c	272 b	2.52 a	0.66 a	0.53 a	3.71 a
25	109 a	4.3 a	32.1 b	332 a	2.30 a	0.73 a	0.55 a	3.58 a
50	110 a	4.5 a	37.0 a	356 a	2.42 a	0.75 a	0.56 a	3.73 a
75	111 a	4.6 a	37.4 a	372 a	2.22 a	0.74 a	0.74 a	3.70 a
100	110 a	4.4 a	38.3 a	368 a	2.27 a	0.69 a	0.69 a	3.65 a
Mean	108.8	4.22	33.9	340	2.34	0.71	0.56	3.67
1997/1998 Season								
0	109 b	3.50 b	25.9 B	316 b	2.13 a	0.49 a	0.71 a	3.33 a
25	117 a	3.95 a	33.7 a	446 a	2.03 a	0.51 a	0.72 a	3.26 a
50	118 a	4.00 a	35.3 a	460 a	2.07 a	0.59 a	0.75 a	3.41 a
75	118 a	4.15 a	37.5 a	469 a	2.01 a	0.57 a	0.72 a	3.30 a
100	117 a	4.05 a	36.7 a	472 a	2.00 a	0.57 a	0.70 a	3.27 a
Mean	115.8	3.93	33.8	432.6	2.05	0.54	0.72	3.31

N levels. Application of 75 Kg N /fad level produced the highest number of leaves / stalk (4.6 & 4.15) and the unfertilized treatment gave the lowest ones (3.3 & 3.5). This was true in both seasons. However, the differences among 25, 50, 75 and 100 Kg N /fad levels were insignificant.

The effect of N on number of active green leaves / stalk is mainly due to the role of N as an essential nutritive element for plant growth.

These results agree with those obtained by ***El-Salhy (1991) and Adam (1992)*** who found that adding 80 Kg N/fad caused a significant increase in number of blades / plant.

I.1.c. Flag leaf area (cm^2):

Flag leaf area significantly increased by increasing N levels. Application of 75 or 100 Kg N /fad recorded the heighest flag leaf area and the control treatment gave the lowest area. This was true in both seasons. Adding 25, 50, 75 and 100 Kg N/fad increased flag leaf area over the check treatment by 29.95, 49.80, 51.42 and 55.06% in 1995/96 season. The same N levels significantly increased flag leaf area by 30.12, 36.29, 44.79and 41.7% in 1997/98 season, respectively. It is worthy to mention that increasing flag leaf area with increasing N application reflect the important role of N in building up the photosynthetic apparatus. These results agree with those obtained by ***Abo-Shetaia and Abdel – Gawad (1995) and Attallah and El- Karamity (1997).***

I.1.d. Number of stalks/m^2:

Data recorded in Table (3) indicate the significant differences among the mean values of number of stalks/m^2 due to adding N levels. This was true in both seasons. Differences among 25, 50, 75 and 100 Kg

N/fed levels were not significant. It could be concluded that the application of N had positive effect on number of stalks/m^2 of wheat which indicates the vital role of N in tillering and plant growth of wheat. Similar results were reported by ***Abdel-Maaboud (1991) and El-Gazzar et al. (1993)***.

I.1.e. Dry weight of different plant organs (g):

The effects of N treatments on the dry weight of stems, leaves, spike and total weight of a plant at 90 days from planting are shown in Table (3).

It is observed that, insignificant increases were observed in organs such as: stem, leaves, spikes and total dry weight / plant as a result of nitrogen application in both seasons. Never theless, all increases were not great enough to reach the 5% level of probability . On the other hand, ***Adam (1992) and Hegab (1994)*** showed that dry weight of plant was significantly increased by increasing N from 20 to 80 Kg N /fad.

It was obvious that plant height, number of leaves / stalk, flag leaf area and number of stalks /m^2 at 90 days from planting were increased by increasing N levels. These results may be due to the role of N fertilizer in improving vegetative growth by increasing cell division as well as elongation of cells ***(Marschner, 1986)***. The encouraging effect of N on the vegetative growth of wheat plant is clearly illustrated. The results are also good manifestation of the role of N as an essential element for all plants in general and cereals in particular.

Table (4): Yield and yield components of wheat as influenced by N rate in 1995/96 and 1997/98 seasons

Characters / N-levels (Kg/fad)	Plant height (cm)	No. of Stalks/ m2	No. of spikes /m^2	Spikes wt/m2 (g)	No. of grain/spike	Spike grain weg. (g)	Weight of 1000-grain (g)	Grain yield (kg/fad)	Straw yield (kg fad)	Biological Yield (Kg/fad)	Harvest index
1995/96 Season											
0	103 b	204 b	184 b	500 b	42 c	1.97 c	48.8a a	1584 b	3416 b	5000 c	31.68j a
25	111 a	256 a	224 ab	732 a	49 b	2.21 b	46.3 a	2044 a	4676 a	6720 b	30.41 a
50	112 a	276 a	248 a	736 a	54 a	2.37 a	45.6 ab	2312 a	4678 a	6990 ab	33.08 a
75	113 a	294 a	251 a	726 a	55 a	2.43 a	43 b	2267 a	4613 a	6880 ab	32.95 a
100	113 a	292 a	259 a	748 a	54 a	2.38 a	42.3 b	2321 a	5049 a	7370 a	31.49 a
Mean	110.4	3264.4	233.2	688.4	51.2	2.27	45.2	2105.6	4486	6590	31.92
1997/98 Season											
0	108 c	212 c	196 c	520 c	41 c	1.86 c	47.6 a	1382 c	3675 b	50550 c	27.33 a
25	115 b	260 b	240 b	658 b	46 b	2.07 b	44.6 ab	1728 b	4872 a	66570 b	25.95 a
50	117 a	292 a	268 a	714 a	51 a	2.20 ab	43.0 ab	1989 a	5218 a	72240 ab	27.53 a
75	116 a	296 a	272 a	746 a	52 a	2.35 a	3.1 b	1986 a	5524 a	75180 a	26.41 a
100	115 b	296 a	272 a	740 a	51 a	2.26 a	42.4 b	1981 a	5628 a	76120 a	26.02 a
Mean	114.2	271.2	249.6	675.6	48.2	2.14	44.3	1813.2	4983	6810	26.64

34.8 and 36.7% in 1995 /96 and 1997 / 98 seasons, respectively. The present results indicates clearly that N increased number of spikes/m^2 due to increase number of stalks /m^2. Similar results were obtained by ***Roshdy and Kassem (1988) and Abdel – Maaboud (1991)*** who showed that number of spikes /m^2 increased by increasing N level from 50 to 75 Kg N/fad.

I.2.d. Spikes weight/m^2:

Results showed that the differences among the average values of spikes weight/m^2, as affected by N fertilizer levels, were significant in the two experimental seasons (Table 4). Adding 50, 75 and 100 kg N/fad significantly increased spikes weight /m^2 by 47.2, 45.2 and 49.6% in 1995 /96 season and by 37.3, 43.5 and 42.3% in 1997 /98 season, respectively. These results indicate clearly to the role of N as a major nutritive element for wheat plants grown in this soil. It is known that N is a constituent of chlorophyll, protoplasm, RNA and DNA. Differences among the three N levels in both seasons were not significant. These results agree with those obtained by ***El-Debaby et al. (1994 b) and Salwau (1994).***

I.2.e. Number of grains / spike:

Application of 50, 75 or 100 Kg N/fad produced the highest values of number of grains / spike. This was true in both seasons. Such increases due to adding 50, 75 and 100 Kg N/fad over the unfertilized treatment were 22.7, 25.0 and 22.7% in 1995 /96 season and by 24.4, 26.8 and 24.4% in 1997 /98 season, respectively. This increase in number of grains / spike due to adding N fertilizer may be due to the pollination and fertilization increases of wheat plants.

Similar results were obtained by ***El-Salhy (1991), Shams El-Din and El-Habbak (1992);*** they found that adding 80 Kg N/fad level was superior than other levels.

I.2.f. Spike grain weight (g):

Results in Table (4) showed that spike grain weight significantly increased by increasing N levels up to 75 Kg N/fed. This was true in both seasons. Appliction of 75 Kg N/fed increased spike grain weight over the control treatment by 23.4 and 26.3% in 1995/96 and 1997 / 98 seasons, respectively. The accumulation of synthesized metabolites resulted in a high dry matter accumulation and finally high spike grain weight due to adding 75 Kg N/fad. Similar results were also reported by ***Roshdy and Kassem (1988), Abdel- Gawad et al. (1993)*** who indicated that increasing N dose from 40 up to 80 Kg N/fad significantly increased grain weight /spike.

I.2.g. 1000 grain weight (g):

Data on the 1000-grain weight of wheat as affected by N fertilizer levels in 1995 /96 and 1997/98 seasons are shown in Table (4). Nitrogen fertilizer treatments significantly decreased 1000-kernel weight in both seasons. The higher N level (100 Kg N/fad) produced the lowest weight and the check treatment recorded the highest weight. Difference among zero, 25 and 50 Kg N/fad in 1995 /96 season as well as among 25, 50, 75 and 100 Kg N/fad levels in 1997 /98 season were not significant. Increase of N levels significantly decreased 1000-grain weight and this may be due to increase of plant lodging. These results are in good agreement with those reported by ***Ibrahim (1988)*** who found that 1000–grain weight was significantly decreased by increasing N level up to 100 Kg N/fad.

El-Debaby et al. (1994 b) reported that adding 75 Kg N/fad increased 1000-grain weight. The difference among 60, 75 and 90 kg N/fad was insignificant. On the other hand, ***Zahran and Mosalem (1993)*** reported that 1000-grain weight was not significantly affected by N levels.

I.2. Grain, straw and Biological yields and harvest index

I.2.h. Grain yield (Kg/fad):

Results regarding the effect of N fertilizer levels (0, 25, 50, 75 and 100 Kg N./fad) on the grain yield in 1995 /96 and 1997 / 98 seasons are presented in Table (4). The results showed that N fertilizer significantly increased grain yield in both seasons. Applying 25, 50, 75 and 100 Kg N/fed increased grain yield over the check treatment by 460, 728, 683 and 737 Kg/fad in 1995 /96 season and by 346, 607, 604 and 599 Kg /fad in 1997 /98 seasons, respectively. These increases correspond to 29.0, 46.0, 43.1 and 46.5% in the 1st season and by 25.0, 43.9, 43.7 and 43.3% in the 2nd season, respectively. Application of 50 kg N/fad recorded the highest grain yield in both seasons. This level (50 Kg N/fad) was the most effective in increasing grain yield in both seasons. The increase in grain yield due to application of 50 kg N/fad may be attributed to increase plant growth, number of stalks /m^2), number of spikes/m^2, spikes weight/m^2, number of grains / spike, spike grain weight (Tables 3 & 4). The present results indicate the vital role of N in plant life and its contribution in increasing the grain yield. Such results clarified that N is essential for cell division and elongation as well as root growth and dry matter content of wheat plants. The present results are in accordance with those reported by ***Ibrahim (1988), Mcdonald (1988), Salem et al. (1989), Mhgoub (1990), Adam (1992), Shams El-Din and El-Habbak (1992),*** who indicated that application of 60, 80 and 100 Kg N/ fad increased grain yield over the check treatment by 50.7, 67.5 and 52.6%, respectively. The same trend was ***Obtained by Abo- Warda (1989 & 1993), Fayed et al (1993), El- Zein (1994), Mady (1996) and Abd El- All (1999)*** She found that applying N at 30, 60, 90, 120 and 150 kg/fad significantly increased grain yield over the control by 55.67, 74.21, 84.80, 85,30 and 91,01 %, respectively. However, no significant difference was noticed between 45 and 75 Kg N/fad. ***(Salwau, 1994).***

I.2.i. Straw yield (Kg/fad):

Results showed that the differences among the average values of straw yield as affected by N fertilizer levels in both experimental seasons (Table 4). Adding 25 Kg N/fad produced the highest straw yield /fed. Differences among 25, 50, 75 and 100 kg N/fad were not significant. Application of 25 Kg N/fad increased straw yield over the control treatment by 36.9 and 32.6% in 1995 /96 and 1997/98 seasons, respectively. Nitrogen fertilization improving vegetative growth by increasing cell division as well as elongation cells ***(Marchner, 1986).*** Similar results were obtained by ***Adam (1992), Shams El-Din and El-Habbak (1992) and El-Debaby et al. (1994 b)*** who found that application of 60 or 75 or 90 Kg N/fad produced the highest straw yield /fad.

I.2.j. Biological yield (Kg /fad):

Application of N rates up to 50 Kg N /fad significantly increased biological yield in both seasons (Table 4). Increases in biological yield over the unfertilized treatment in 1995/96 season reached 34.4, 39.8, 37.6 and 47.4% at 25, 50, 75 and 100 kg N/fad levels, respectively. In 1997 /98 season, the respective increases in this trait were 31.7, 42.2, 48.7 and 50.6%. The accumulation of synthesized metabolites resulted in a high dry matter accumulation and finally high biological yield /fad. These results may be attributed to the increase of plant growth, grain yield and its components as well as straw yield (Table 3 & 4). Similar results were also reported by ***Adam (1992), Abd El-Gawad et al. (1993), Agbary, et al. (1993), Mohamed (1993) and Salwau (1994).***

I.2.k. Harvest index:

It was observed that harvest index was affected due to the increase in N level as shown in Table (4). The highest harvest index was obtained at 50 kg N/fad level (33.08 % & 27.53%) in both seasons. Data revealed that the differences among N levels were not significant during the both seasons. The present results agree with those reported by ***Mostafa et al. (1997),*** Who reported that harvest index increased with increasing N levels from 30 to 120 kg/fad.

I.3. Chemical composition:

The effect of N fertilization levels (0, 25, 50, 75 and 100 Kg N/fad) on curde protein, P and K percentages of wheat grains and straw through both growing seasons are presented in Table (5).

I.3.a. Crude protein content (%):

Results show that the application of 75 Kg N/fed gave the highest mean values of crude protein percentage, which were 11.75 and 2.50% in 1995 /96 season and 11.49 and 2.70% in 1997 /98 season for grains and straw, respectively (Table 5). The differences among 50, 75 and 100 kg N/fad in both seasons were not significant. Applying 50-100 kg N/fad was significantly superior in the stimulation of N absorption from the soil. This increase in crude protein might be due to the important role of nitrogen in biulding up of suitable leaf area and thus increasing the

Table (5): Effect of N fertilizer levels on crude protein, phosphorus and potassium concentrations in wheat grains and straw in 1995/96 and 1997/98 seasons.

Chemical compo-Sition / N-level (kg/fed)	Crude Protein %		Phosphorus %		Potassium %	
	Grains	Straw	Grains	Straw	Grains	Straw
1995/96 season						
0	10.17c	1.82 c	0.318 a	0.181 a	0.122 b	0.250 b
25	11.53b	2.27 b	0.329 a	0.190 a	0.138 a	0.281 a
50	11.69 a	2.28 a	0.333 a	0.191 a	0.143 a	0.295 a
75	11.75 a	2.50 a	0.344 a	0.194 a	0.141 a	0.295 a
100	11.52 a	2.44 a	0.353 a	0.196 a	0.133 a	0.287 a
1997 /98 Season						
0	10.75 c	1.78 c	0.322 a	0.178 a	0.099 b	0.305 b
25	11.24 b	2.18 b	0.331 a	0.182 a	0.114 a	0.343 a
50	11.35 a	2.55 a	0.342 a	0.187 a	0.115 a	0.358 a
75	11.49 a	2.70 a	0.350 a	0.190 a	0.117 a	0.360 a
100	11.48 a	2.48 a	0.335 a	0.185 a	0.117 a	0.375 a

accumulation of photosynthates and converting them into protein contents. In addition, nitrogen is essential for some plant enzymes, chlorophyl formation, DNA and RNA synthesis. ***Marscher, (1986).***

Consequently, a good supply of N may lead to better plant growth and more metabolic activity in plants. Similar results were also obtained by ***Abd El-Maaboud (1991), Morsy (1993) and El-Badry (1995).***

I.3.b. Phosphorus content (%):

With regard to the effect of application of N fertilizer levels on P% of grain and straw was not affected in both seasons. However, slight and insignificant increases in P (%) were observed as a result of increased N rates in both seasons. Similar results were also obtained by ***Ibrahim (1988) and El-Salhy (1991).***

I.3.c. Potassium content (%):

Results of K concentration in grains and straw as a result of application of N rates are also shown in Table (5).

The applied N levels did enhance potassium percentage of grains and straw in both seasons in comparison with the control (zero N). Yet, the differences in K contents among the last four levels were not significant. The effect of N levels on K percentage of wheat plants may be due to the effect of N in the stimulation of root growth, vegetative growth as well as total dry matter content of wheat plants. Similar results were also obtained by ***Adam (1992)***, who found that increase of applied N level significantly increased K percentage of wheat grains and straw. On the other hand, ***Mohamed (1993)*** showed no significant effect on K percentage due to N application. The present results indicate clearly the vital role of N in wheat life and its contribution to increase the grains yield and quality of wheat.

Under this experiment conditions, it seems that the application of 50 Kg N/fad rate was the best among the other utilized rates for wheat quality and quantity, as expressed in crude protein, phosphorus and potassium concentrations as well as grain yield/fad.

II- Wheat response to foliar application of Folactive:

Results respecting the effect of foliar application of Folactive treatments on growth characters, grain yield and yield components as well as chemical composition of wheat in 1995 /96 and 1997 /98 seasons are shown in Table (6).

II.1. Growth characters:

Vegetative growth characters of wheat; namely, plant height, number of leaves /stalk, flag leaf area, number of stalks /m^2, dry weight of different wheat plant organs and total dry weight /plant at 90 days from planting were not affected by Folactive treatments in both season as shown in Table (6).

Results indicated that foliar application of Folactive at all treatments showed no significant effect on growth characters studied in both seasons of experimentation. It was clear that increases in some growth characters were obtained as a result of Folactive application were below the level of significance.

It could be concluded that at 90 days from planting wheat plants failed to show any response to Folactive spraying. Similar results were obtained by ***El- Hattab et al (1986) and Badr et al. (1997),*** who found that growth characters of plants were not affected by foliar application of Agrispon. On the other hand, ***Abd El- Salam and El- Sheikh (1994)*** found significant response on plant growth the of maize due to foliar application with Zn/Mn and Fe.

Table (6): Vegetative growth characters of wheat plant as affected by foliar application of Folactive in 1995 / 1996 and 1997/1998 seasons.

Growth characters / Fol. treatments	Plant height (cm)	No. Leaves stalk	Flag leaf area (cm^2)	No. of Stalks /m^2.	Dry weight (g) of			Total Plant
					Stem	leaves	Spike	
1995/96 season								
FO	108 a	4.15 a	33.1 a	320 a	2.32 a	0.69 a	0.60 a	3.61 a
FT	110 a	4.20 a	34.1 a	360 a	2.30 a	0.72 a	0.59 a	3.61 a
FB	109 a	4.50 a	33.8 a	348 a	2.40 a	0.72 a	0.52 a	3.64 a
(FT and FB 100%)	108 a	4.20 a	34.5 a	328 a	2.38 a	0.70 a	0.55 a	3.63 a
Mean	108.7	4.26	33.8	339	2.35	0.70	0.56	3.62
1997/98 Season								
FO	116 a	3.85 a	32.3 a	442 a	2.06 a	0.50 a	0.70 a	3.26 a
FT	116 a	3.90 a	33.9 a	450 a	2.08 a	0.58 a	0.77 a	3.43 a
FB	115 a	4.00 a	34.0 a	460 a	2.04 a	0.57 a	0.70 a	3.31 a
(FT and FB 100%)	115 a	3.85 a	34.9 a	419 a	1.98 a	0.55 a	0.72 a	3.25 a
(FT and FB 50%)	116 a	4.05 a	34.0 a	432 a	2.09 a	0.55 a	0.71 a	3.35 a
Mean	115.6	3.93	33.8	440	2.05	0.55	0.72	3.34

II.2. Grain yield components:

Results of grain yield components of wheat as affected by Folactive treatments in 1995/96 and 1997 /98 seasons are shown in Table (7).

Results showed that plant height, number of stalks /m^2, number of spikes /m^2, spikes weight /m^2, number of grains /spike, spike grain weight and 1000-grain weight were not significantly affected by Folactive application in both seasons of experimentation. However, all growth characters were favourably affected by Folactive spraying, where insignificant increase were observed as a result of applying Folactive treatments used at the different growth stages.

For example, the number of spikes /m^2 was increased slightly as a result of Folactive application. Increases in number of spikes /m^2 over the control treatment were 12.3, 6.4 and 5% in 1995/96 season and 11.1, 10.3 and 11.1% in 1997/98 season where Folactive was applied at FT, FB and (FT and FB, 100%) treatments, respectively. Since increases were; however, below the 5% level of probability. Also, spikes weight/m^2 of wheat showed slight increases at all treatments of Folactive application. In 1995/96 season when Folactive was applied at FT, FB and (FT and FB, 100%) treatments, spikes weight /m^2 was increased over the control treatment by 11.4, 8.5 and 4.1%, respectively. Such increases were 7.8, 10.0, 4.1 and 4.4% for Folactive Ft, FB, (FT and FB 100%) and (FT and FB 50%) treatments, respectively in 1997 /98 season. On the other hand, number of stalks /m^2 was significantly affected by Folactive foliar application in 1997 /98 season. Applying Folactive at FT, FB and FT + FB (100%) treatments increased number of stalks/m^2 over the unfertilized treatment by 9.3, 8.5 and 8.5%, respectively. In the 1st season, increases in number of stalks /m^2 at all treatments of Folactive application were not significant. Similar results were also reported by ***El – Hattab et al. (1986) and Badr et al. (1997)*** who found that grain yield components in maize were not affected by Agrispon spraying. On the other hand, ***El- Sheikh (1998)*** showed significant response on grain yield and its components of maize due to foliar application with Mn.

II.2. Grain, straw and biological yields and harvest index:

Data for the effect of Folactive treatments on grain yield, straw yield, biological yield and harvest index in 1995/96 and 1997/98 seasons are presented in Table (7).

II.2.h. Grain yield (Kg/fad):

Generally, it was observed that, insignificant increases were found in grain yield /fad as a result of adding Folactive treatments in both seasons. However, all increases were not great enough to reach the 5% level of probability. Such results are expected since growth characters and yield components of wheat showed no response to applied Folactive treatments in both seasons. The present results may be mainly due to on adequate content of total and available most macro and micro-nutrients in the soil. Similar results were also obtained by ***Badr et al. (1997)*** on maize.

II.2.i. Straw yield (Kg /fad):

Foliar application with Folactive significantly increased straw yield in both seasons. Increased straw yield over the control treatment were 7.5, 10.4 and 0.3% as a result of Folactive applied at FT, FB and FT + FB (100%) treatments, respectively. The same trend was obtained in 1997 /98 season.

Table (7): Yield and yield components of wheat as influenced by foliar application of Folactive in 1995 / 96 and 1997/98 seasons

Characters / Fol. Treatment	Plant height (cm).	No. of Stalks/ m2	No. of spikes /m^2	Spikes wt/m2 (g)	No. of grain/spike	Spike grain weg. (g)	Weight of 1000-grain (g)	Grain yield (kg/fad)	Straw yield (kg fad)	Biological Yield (Kg /fad)	Harvest index
1995/96 Season											
FO	112 a	249 a	220 a	634 a	51 a	2.20 a	43.6 a	2016 a	4314 b	6330 b	31.84 a
FT	110 a	273 a	247 a	706 a	51 a	2.25 a	46.1 a	2233 a	4637 a	6870 a	32.50 a
FB	111 a	268 a	234 a	688 a	51 a	2.25 a	46 a	2149 a	4761 a	6910 a	31.09 a
FT+FB(100%)	110 a	270 a	231 a	660 a	52 a	2.36 a	45.1 a	2023 a	4327 a	6350 b	32.01 a
Mean	110.7	265	233	672	51.5	2.26	45.2	2105	4509.7	6610	31.06
1997/98 Season											
FO	114 a	258 a	234 a	642 a	49 a	2.12 a	43.8 a	1739 a	4641 b	63890 b	27.21 a
FT	114 a	282 a	260 a	692 a	49 a	2.17 a	44.8 a	1813 a	5164 a	69870 a	25.94 a
FB	113 a	280 a	258 a	706 a	48 a	2.20 a	45.2 a	1912 a	5172 a	71080 a	26.89 a
(FT and FB 100%)	114 a	280 a	260 a	668 a	49 a	2.15 a	44 a	1774 a	5170 a	69560 a	25.50 a
(FT and FB 50%)	115 a	258 b	238 a	670 a	48 a	2.10 a	43.7 a	1843 a	4781 b	63600 ab	27.70 a
Mean	114	271.6	250	675.6	48.6	2.14	44.3	1816.2	4985.6	6810	26.66

II.2.j. Biological yield (Kg /fad):

Biological yield significantly increased as a result of adding Folactive treatments. Such increases in the 1st season over the unfertilized treatment were 8.5, 9.2 and 0.3%, respectively. In the 2nd season, application of FT, FB, (FT and FB 100%) and (FT and FB 50%) Folactive treatments significantly increased biological yield by 9.4, 11.3, 8.9 and 3.8%, respectively.

However, the differences among Folactive treatments FT, FB, (FT and FB 100%) and (FT and FB 50%) were not significant. These results may be due to increase the straw yield as a result of Folactive applied at FT, FB and (FT and FB 100%) treatments.

II.2.k. Harvest index:

Harvest index as affected by Folactive treatments in both seasons are shown in Table (7). However, slight increases in harvest index was found in the 1st season. All these increases were below the level of significance.

Such results are mainly due to the experimental soil is high fertility where the hand is cropped in a good rotation systems and quietly supplied with mineral fertilizers and animal manure. Therefore, Folactive spraying on wheat plants did not show any significant effect on growth characters and yield components as well as grain yield /fad.

These results agree with those reported by ***Badr et al. (1997)***, who showed that grain yield and its components of maize were not affected by Agrispon application.

It could be concluded that Folactive applied at tillering or booting stage showed no significant effect on growth characters and grain yield components as well as grain yield of wheat.

II.3. Chemical composition:

Data regarding the effect of Folactive compound on crude protein, P and K percentages in grains and straw are shown in Table (8).

II.3.a. Crude protein percentage:

Results show apparently that Folactive treatments did not significantly affect curde protein percentages of grains in both seasons and also of straw in the second season (Table 8). However, the crude protein percentage of straw in the first season was significantly increased by Folactive application versus the control (none Folactive applied).

It is also clear that Folactive applied at its full rate at booting stage of wheat development produced the highest crude protein percentage in the straw (2.15%). The last observation might be due to the various contents of macro-and micro-nutrients of Folactive and their functions in increasing protein synthesis in wheat straw components.

II.3.b. Phosphorus percentage:

Results in Table (8) indicate that Folactive foliar application caused a significant increase in grain P percentage as compared with that of untreated plots in the first season. This result may reflect the importance of foliar application of Folactive contained P in cases of low – available P soil (pH > 7.5). Yet, P concentration of grains in the second season and of straw in both seasons were not affected by Folactive treatments.

Table (8): Effect of foliar application of Folactive on crude protein, phosphorus and potasium concentrations of wheat grains and straw in 1995 /1996 and 97 / 98 seasons.

Characters / Fol.Treatments	Crude protein %		Phosphorus %		Potasium %	
	Grain	Straw	Grains	Straw	Grains	Straw
1995/96 season						
FO	11.29 a	1.85 b	0.309 b	0.198 a	0.127 a	0.288 a
FT	11.59 a	1.97 b	0.33 8 a	0.188 a	0.135 a	0.282 a
FB	11.54 a	2.15 a	0.339 a	0.188 a	0.135 a	0.288 a
(FT and FB100%)	11.44 a	2.10 a	0.355 a	0.188 a	0.145 a	0.276 a
1997 / 98 Season						
FO	11.25 a	1.90 a	0.315 a	0.182 a	0.113 a	0.345 a
FT	11.39 a	1.94 a	0.320 a	0.185 a	0.113 a	0.340 a
FB	11.31 a	2.03 a	0.320 a	0.180 a	0.113 a	0.350 a
(FT and FB100%)	11.22 a	1.97 a	0.315 a	0.180 a	0.115 a	0.347 a
FT and FB 50%)	11.27 a	1.98 a	0.319 a	0.189 a	0.109 a	0.358 a

II.3.c. Potassium percentage:

As for K percentage, results in the same Table (8) indicate that there was no significant effects of Folactive treatments on K concentration of grains and straw in both seasons. This finding might indicate that the soil of the experimental field has sufficient amount of K nutrient, so the Folactive contained macro and micro-nutrients did not increase K percentage in grain and straw. The same trend was obtained by ***Badr et al. (1997)*** on maize.

III- Interaction effects:

The effect of the interaction between N fertilizer levels and foliar application of Folactive treatments on growth characters; namely, plant height, number of leaves/stalk, flag leaf area, dry weight of different plant organs and number of stalks/m^2 of wheat at 90 days from planting were not significant in both seasons. Grain yield and yield components; namely, number of stalks, plant height, spikes weight /m^2, number of spikes /m^2, 1000- grain weight, straw yield, biological yield and harvest index in both season and number of grains/ spike, spike grain weight during 1st were not significant, N levels X Folactive treatments. Also, chemical composition, namely, crude protein and P percentages of grains and straw in both seasons were not affected by N levels X Folctive treatments. Consequently, the data were excluded.

III.1 Number of grains / spike:

Results of Table (9) indicated a significant effect of the interaction between soil – applied N and foliar applied Folactive on the number of grains / spike in both seasons. Application of Folactive at booting stage gave the greatest number of grains / spike as compared with other interactions. This result was expected previously since each of those treatments of N and Folactive tended to produce more grains /spike. Data of the same Table indicate that various Folactive treatments applied at the same 75 Kg N rate did not significantly differ in between. Meanwhile, values of grain number / spike were much different with application of various N rates under the same Folactive treatment of booting stage. This interaction reflects the fact that soil – applied N treatments were more important than those of Folactive for wheat yields in this investigation.

Table (9): Effect of the interaction between N. levels and foliar of Folactive on number of grains / spike, in 1995/96 and 1997/98 seasons.

N- levels (kg/fad) / Fol. treatments	0		25		50		75		100	
1995/96 Season										
FO	44 C	ab	48 BC	a	53 AB	a	55 A	a	54 A	a
FT	42 C	b	48 B	a	57 A	a	54 A	a	54 A	a
FB	44 C	ab	49 B	a	55 A	a	57 A	a	48 BC	b
FT and FB 100%)	46 C	a	53 AB	a	52 B	a	56 A	a	57 A	a
1997 / 98 Season										
FO	41 C	a	45 BC	a	50 AB	ab	52 A	ab	54 A	A
FT	41 B	a	45 B	a	54 A	a	51 A	a	52 A	A
FB	41 B	a	46 B	a	52 A	ab	54 A	ab	45 B	A
FT and FB 100%)	42 C	a	50 AB	a	48 B	b	53 AB	b	54 A	A
FT and FB 50%)	42 C	a	46 BC	a	49 AB	ab	51 AB	ab	53 A	a

III.2. Grains weight /spike:

Interaction of applied –N and Folactive treatments on the dry weight of grains / spike exhibited a significant effect in 1997 /98 only (Table 10). Similarly, according to the above mentioned interaction effect, the highest weight of grains /spike (2.46 g) was obtained from using Folactive at booting stage with 75 Kg N/fad as soil application. The obtained increases in number of grains/spike might be the main reason for those observed in the weight of same grains as for the same best interaction treatment.

III. 3. K% in straw:

Results in Table (11) showed that the interaction effect of soil – applied N rates and foliar – applied Folactive on K concentration of wheat straw was significant in both seasons. Application of 50 Kg N rate with applying Folactive at various stages resulted in significant increases in K concentration as compared with those of untreated Folactive under the same N rate in the first season. However, the lower value of K percentage was observed with Folactive that applied twice at both tellering and booting stages at full rate each without nitrogen application. Under this interaction effect, wheat growth was restricted by N deficiency, so plants could not absorb and translocate nutrients including potassium. In 1997/98 season, Folactive foliar application at (FT and FB, 50%) with the rate of 100 Kg N /Fad resulted in the highest K percentage in straw in the second season. Results of the same season indicate that the various Folactive treatments under the same N level did not exhibit any significant differences. Yet, some significant differences in K percentage as due to applying the different N levels under the same Folactive treatment could be observed. This in turn leads to the relevant importance of N than Folactive in concentrating K of wheat straw.

Table (10): Effect of the interaction between N-levels and foliar application of Folactive treatments on spike grain weight in 1995 / 96 and 1997 / 98 seasons.

N- levels (Kg/fad) / Fol. Treatment	0		25		50		75		100	
1995/96 Season										
FO	1.79 A	a	2.15 A	a	2.34 A	a	2.33 A	a	2.40 A	a
FT	1.98 A	a	2.08 A	a	2 49 A	a	2. 42 A	a	2.31 A	a
FB	2.00 A	a	2.22 A	a	2.37 A	a	2. 45 A	a	2.24 A	a
(FT and FB100%)	2.12 A	a	2. 38 A	a	2.26 A	a	2.51 A	a	2.54 A	a

N.S

Table (10): Effect of the interaction between N-levels and foliar application of Folactive treatments on spike grain weight in 1997 / 98 season.

N- / Folactive	0		25		50		75		100	
1997/98 Season										
FO	1.89 C	a	2.13 AB	a	2.07 B	b	2.29 A	b	2.20 AB	bc
FT	1.87 C	a	2.08 B	a	2.23 AB	ab	2.33 A	ab	2.33 A	ab
FB	1.88 C	a	2.12 B	a	2.13 A	b	2.46 B	a	2.39 A	a
(FT and FB100%)	1.84 D	a	2.00 C	a	2.36 A	a	2.32 AB	ab	2.24 AB	abc
(FT and FB 50%)	1.83 C	a	1.98 C	a	2.20 AB	ab	2.35 A	ab	2.16 AB	c

Table (11): Interaction effect of N levels and Folactive treatments on potasium percentage of wheat straw in 1995 / 96 and 1997 / 98 seasons.

N-level (Kg/Fad) / F-treat	0		25		50		75		100	
					1995/96 season					
Fo	0.267BA	b	0.280 A	ab	0.260 B	b	0.370 A	a	0.287 A	ab
FT	0.248 B	c	0.290A	ab	0.317 A	a	0.292 A	ab	0.270 B	bc
FB	0.281 AB	a	0.277 A	a	0.290 A	a	0.285 A	a	0.305 A	a
(FT and B 100%)	0.207 C	c	0.277 A	b	0.315 A	a	0.295 A	ab	0.287 A	ab
					1997 / 98 Season					
FO	0.317 A	c	0.332 A	bc	0.350 A	ab	0.350 A	ab	0.375 A	a
FT	0.315 A	b	0.342 A	ab	0.317 A	b	0.360 A	a	0.367 A	a
FB	0.310 A	b	0.342 A	a	0.372 A	a	0.355 A	a	0.370 A	a
(FT and FB 100%)	0.287 A	c	0.345 A	b	0.370 A	ab	0.355 A	ab	0.380 A	a
(FT and FB 50%)	0.295 A	c	0.352 A	b	0.380 A	ab	0.380 A	ab	0.385 A	a