RESULTS AND DISCUSSION

I-Chemical and biological Properties of the soil

A- Effect of seedbed preparation

Results presented in Table (4) show some chemical and biological properties of the soil as influenced by seedbed preparation treatments in 1995 and 1996 growing seasons:

1-pH:

Results in Table (4) showed that pH value was not affected by seedbed preparation treatments in both seasons.

pH value after the five seedbed preparation treatments was nearly similar with very slight differences.

In 1995 season, the highest pH value was recorded with no-tillage (7.86) and the lowest one was obtained by moldboard plow (once) + chisel plow (once) treatment (7.75).

In 1996 season, the maximum value (7.87) was observed after chisel plow (once) treatment and the minimum value (7.73) was recorded after moldboard plow (once) treatment.

It could be concluded that there was no relevence between seedbed preparation and soil pH value. **Dowdy et al. (1993)** reported that no-till maize decreased soil pH. **Gomaa and El-Nagger (1995)** indicated that soil pH tended to decrease with depth in no-tillage and chisel plow, but slightly increased with moldboard plow. **Lai (1997)** found that mean soil

pH for the 0-5cm depth declined from 6.7 to 5.6 in no-till + residu mulch and from 6.7 to 5.5 with moldboard plow.

2- Electrical Conductivity (E.C.):

Values of electrical conductivity (E.C.) in mmhos / cm as influenced by seedbed preparation are presented in Table (4):

Results show some differences in E.C values due to the seedbed preparation treatments in both seasons.

In the first season the greatest E.C. value was recorded with no-tillage treatment (1.26 m mhos / cm) whereas, the lowest one (1.05 m mhos /cm) was recorded with moldboard plow (once) + chisel plow (once) treatment.

In the second season, the lowest E.C. value was obtained by moldboard plow (once), being 1.10 m mhos / cm. The highest E.C. value (1.27 m mhos / cm) was recorded with no – tillage treatment.

It could be noticed that the E.C. values were markedly lower with moldboard plow (once) as well as moldboard plow (once) + chisel plow (once) treatments compared with no-tillage, this may be due to the soil structur improvement which contribute to good penetration and percolation of water throughout the soil profile carrying salts from the upper layer of soil to the lowest one.

These results are in line with the findings of. **Ismael (1980)** who found that by using either moldboard or disk plows in seedbed preparation, salts were nearly inverted from the upper layer to the lowest one whereas, salts were mixed by using chisel plow. **Gomaa and El-**

Naggar (1995) indicated that moldboard and chisel operation reduced the E.C. value. **Gomaa (1996)** found that the lowest E.C. vlaue was recorded with subsoiling + chisel plowing.

3-Organic matter:

The effect of seedbed preparation on organic matter content of the soil is shown in Table (4).

Organic matter percentage in the soil increased by plowing the soil either by chisel or moldboard plow in both seasons.

In 1995 season, organic matter percentage increased from 1.98% at no-tillage to 2.02, 2.21, 2.27 and 2.32 % due to using chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once) + chisel plow (once) respectively, (Table 4).

In 1996 season, using chisel plow once or twice as well as moldboard plow either alone or with chisel plow once for each increased soil organic matter ratio from 2.11 at no-tillage up to 2.14, 2.24, 2.33 and 2.36% for the four mentioned treatments, respectively, (Table 4). The increase in soil organic matter content due to plowing is mainly attributed to soil porosity which improve soil aerification and this stimulate soil micro-organism activity in organic matter decomposition as well as the increase in number of such organisms.

Lai (1997) found that the organic carbon content of the 0-5cm depth was 13.9 g kg^{-1} for the no-till treatment compared with 11.9 g Kg^{-1} for the plough based methods.

4-Total nitrogen:

Total nitrogen percentage in the soil as influenced by tillage treatments is illustrated in Table (4).

Tillage treatments increased soil total nitrogen percentage in both seasons.

In the first season soil total nitrogen percentage were 0.17, 0.17, 0.19, 0.20 and 0.22% for no-tillage, chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once)+ chisel plow (once), respectively.

In 1996 season, plowing raised soil total nitrogen percentage from 0.18% for no-tillage to 0.19, 0.19, 0.21 and 0. 22% for the four mentioned treatments respectively. (Table 4).

The increase in soil total nitrogen percentage as a result of plowing may be attributed to the increase in organic matter content of the soil and its decomposition after plowing treatments.

Similar results were obtained by **Horn et al. (1992)** who found that different tillage practices gave rise to different distribution patterns of nutrients in surface layers. On the other hand **Campbell et al. (1996)** observed that no-tillage increased organic C and N concentrations in the 0-7.5 cm soil depth, however, there was no effect for tillage on C and N concentration in the 7.5 –15 cm depth .

5-Total phosphorus:

Soil total phosphorus percentage increased by soil plowing either by chisel or moldboard plow as shown in Table (4).

Phosphorus percentage increased from 0.44% at no-tillage to 0.49, 0.52, 0.52 and 0.55% for chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once) + chisel plow (once) respectively, in the first season.

In 1996 season, soil total phosphorus percentages were, 0.47, 0.50, 0.52 0.55 and 0.55% for the five mentioned treatment of seedbed preparation respectively (Table 4).

It could be concluded that soil total phosphorus percentage was increased due to the soil plowing by chisel or moldboard plow either alone or together and that the highest value was obtained by using moldboard with chisel plow once plowing for each.

These results may be attributed to the increase in organic matter content of the soil.

6-Available nitrogen:

Available nitrogen in the soil was influenced by seedbed preparation in both seasons of the experiment as shows in Table (4).

Plowing soil by chisel plow once or twice or by moldboard alone or with chisel increased soil available nitrogen by 5.67, 9.85, 11.17 and 13.72 p.p.m respectively compared with no- tillage in the first season.

The respective increases in available nitrogen in 1996 season were 4.58, 4.82, 10.52 and 10.92 p.p.m respectively, for the four seedbed preparation compared with no-tillage (Table 4).

It could be concluded that plowing increased available nitrogen content of the soil. This increase is mainely due to the role of plowing in

stimulating micro-organisms activity and organic matter decomposition as well as nitrogen convertion to available form.

Similar conclussion was obtained by **Conti et al. (1990)** who indicated that mineralized organic N concentration was greatest with chisel plow and a preceding soybean crop, but nitrate concentration was greatest with chisel plow and no preceding soybean crop. On the other hand **Aflakpui et al. (1993)** found that the tillage systems hand no apparent influence on N availability to maize.

7-Available phosphorus:

Data in Table (4) show the effect of seedbed preparation on the available phosphorus in the soil.

Results revealed that soil available phosphorus increased by plowing in the two successive seasons.

In the first season, using chisel plow once or twice, moldboard plow alone or with chisel plow increased available phosphorus by 0.27, 4.05, 4.97 and 7.12 p.p.m compared with no-tillage respectively.

In the second season, the increases in available phosphorus were 0.98, 1.42, 4.63 and 4.72 due to chisel plow once or twice and moldboard plow alone or with chisel plow, respectively, (Table 4).

It could be concluded that plowing by either chisel or moldboard plow alone or together increased soil available phosphorus.

This increase may be attributed to the role of plowing in activating the soil miro-organisms to convert phosphorus to the available form.

Table (4): *Effect of seedbed preparation on soil chemical and biological properties at harvest in 1995 and 1996 seasons.*

Characters / Seedbed preparation	pH	E.C. m.mhos/cm	Organic matter (%)	Total nitrogen (%)	Total phosphorus (%)	Avaliable nitrogen (p.p.m)	Avaliable phosphorus (p.p.m)	Bacterial counts (counts x10^{3}g dry weight of soil)
Season				**1995**				
No-tillage	7.86	1.26	1.98	0.17	0.44	41.28	24.88	21.51
Chisel plow (once)	7.82	1.15	2.02	0.17	0.49	46.95	25.15	24.49
Chisel plow (twice)	7.77	1.16	2.21	0.19	0.52	51.13	28.93	29.45
Moldboard plow (once)	7.76	1.13	2.27	0.20	0.52	52.45	29.85	34.14
Moldboard plow (once) +chisel plow (once)	7.75	1.05	2.32	0.22	0.55	55.00	32.00	35.22
Season				**1996**				
No-tillage	7.84	1.27	2.11	0.18	0.47	43.58	27.78	26.33
Chisel plow (once)	7.87	1.25	2.14	0.19	0.50	48.16	28.76	26.45
Chisel plow (twice)	7.84	1.21	2.24	0.19	0.52	48.40	29.20	31.82
Moldboard plow (once)	7.73	1.10	2.33	0.21	0.55	54.10	32.41	37.31
Moldboard plow (once) + chisel plow (once)	7.81	1.12	2.36	0.22	0.55	54.50	32.50	38.32

8-Bacterial Counts:

Results in Table (4) indicate clearly that plowing soil by chisel plow, once or twice or by moldboard plow alone or with chisel plow increased number of azospirilla over that with no-tillage by 2.98, 7.94, 12.63 and 13.71 x 10^5 /g dry weight of soil, respectively, in the first season. The corresponding increases in the second season were 0.13, 5.49, 10.98 and 11.99 x 10^5 /g dry weight of soil, respectively.

It was clear that moldboard plow alone or with chisel plow gave the highest number of azospirilla followed by chisel plow (twice) and chisel plow (once). Whereas, the lowest number of azospirilla was obtained with no-tillage treatment.

It could be concluded that moldboard plow alone or with chisel plow gave the best number of azospirilla in the soil. This increase is mainly due to the soil structure improvement which contribute to good micro-organisms activity in organic matter decomposition and increased the availability of most nutrient elements and micro-nutrients which encourage the proliferation of different soil micro-organisms.

B-Effect of biological fertilizers:

Results illustrated in Table (5) show the effect of biological fertilizers on some chemical and biological properties of the soil in 1995 and 1996 seasons.

1-pH:

Results of soil pH values as influenced by biological fertilizers are presented in Table (5).

Results indicated that biological fertilizers, namely, agrispon and bacterial inoculation did not affect soil pH value in both experimental seasons.

PH value did not differ under different biological fertilizer treatments.

It could be concluded that there was no pertinence between biological fertilizers and soil pH value.

2-Electrical conductively (E.C.):

E.C. value of the soil was not greatly differed under different biological fertilizer treatments in both seasons (Table 5).

Different ferlilizer treatments showed nearly similar effect on E.C. value of the soil.

It could be concluded that soil E.C. was not affected by biological fertilizers .

3-Organic matter:

Results of the effect of biological fertilizers on soil organic matter content are shown in Table (5).

Results revealed that soil organic matter was affected by different biological fertilizers treatments in both seasons as illustrated in Table (5).

The soil organic matter content increased by bacterial inoculation as well as bacterial inoculation with agrispon treatment by 0.06 and 0. 13% compared with control treatment in the first season and by 0.05 and 0.08% in the second one, respectively.

The increase in soil organic matter content due to bacterial inoculation may be due to the increase in number and weight of micro-organisms in the soil. These results confirm those obtained by **Zaghloul et al. (1996b)** in wheat, who found that the inoculation of grains with Vesicalar arbusular mycorrhiza (VAM) or phosphate solubilizing bacteria in the presence of effective strain of Azospirillum brasilense led to increasing the orgainc carbon percentage compared with the uninoculated treatments.

4-Total nitrogen:

The effect of biological fertilizers treatments on total nitrogen percentage of the soil are illustrated in Table (5).

Soil total nitrogen percentage increased by bacterial inoculation or agrispon application reaching the highest value (0.20 %) by agrispon + bacterial inoculation or foliar application of agrispon compared with 0.18 and 0.19% at control treatment in the first and second season, respectively.

The increase in total nitrogen content due to bacterial inoculation may be attributed to the increase in number and weight of micro-organism as well as nitrogen fixation by bacteria in the soil.

These results are in agreement with the findings of **Zaghloul et al. (1996b)** who found that the biofertilizer treatments increased total nitrogen in soil compared with the non-inoculated ones. **El-Sayeda (1997)** found that the biofertilizers increased total nitrogen in the soil with increasing growth period of plant to reach its maximum values at 60 days from sowing.

5-Total phosphorus:

Table (5) shows soil total phosphorus percentage as influenced by bacterial inoculation as well as agrispon treatments.

Total soil phosphorus percentage increased by bacterial inoculation as well as agrispon application in both season of the experiment.

In 1995 season, the highest total phosphorus value (0.53%) was obtained by bacterial inoculation followed by agrispon application (0.51%) then agrispon + bacterial inoculation (0.50%). The lowest value (0.48%) was recorded under the control treatment.

In 1996 season, agrispon + bacterial inoculation gave the highest value of total phosphorus percentage (0.53%) followed. by bacterial inoculation (52%). Both agrispon and control gave the same lowest value (0.50%).

It could be concluded that bacterial inoculation alone or in addition to agrispon increased soil total phosphorus content.

This result is in line with **Zaghloul et al. (1996 a)** who found that Azospirillum brasilense as a biofrtilizer increased soil total phosphorus content compared with using the organic manures. Also **Zaghloul et al. (1996 b)** found that the biofertilizer treatments increased total phosphorus in soil compared with untreated ones.

6-Available nitrogen:

Available nitrogen percentagc in soil as affected by biological fertilizer treatments in the two seasons of the experiment is shown in Table (5).

Agrispon application as well as bacterial inoculation caused an increase in available nitrogen value in both seasons.

In the first season, the highest value of available nitrogen was recorded by agrispon application (49.98 p.p.m) followed by agrispon + bacterial inoculation (49.64 p.p.m) then bacterial inoculation (49.08%). The lowest value was recorded by control treatment (48.76 p.p.m).

In 1996 season, agrispon + bacterial inoculation recorded the greatest value of available nitrogen in the soil (50.29 p.p.m) followed by agrispon alone (50.24 p.p.m) then bacterial inoculation alone (49.95 p.p.m). The control treatment gave the lowest value (48.44 p.p.m).

It is clear that agrispon alone or accompanied with bacterial inoculation gave the highest value of available nitrogen in the soil.

The increase in available nitrogen of the soil due to bacterial inoculation is mainly due to the role of bacteria in organic matter decomposition as well as the conversion of total nitrogen to available form.

Similar conclusion was obtained by **Kabesh et al. (1975)** who found that biofertilizers, either solely or in combination with certain chemical additives was efficient in increasing available nutrients in the soil. **Zaghloul et al. (1996 a)** found that ammonical and nitrate nitrogen in soil increased by bacterization with associative N_2 – fixer (Azospirillum brasilense)

7-Available phosphorus:

Biological fertilizer increased available phosphorus in the soil compared with the control treatment in both seasons as recorded in Table (5).

In the first season, agrispon alone or combined with bacterial inoculation increased available phosphorus value of the soil from 27.56 p.p.m at control treatment to 28.78 and 28.44 p.p.m , respectively. A slight increase (0.3 p.p.m) was due to bacterial inoculation alone.

Similar trend was noticed in the second season where the highest value of available phosphorus was recorded by agrispon + bacterial inoculation (30.69 p.p.m) as well as agrispon alone (30.64 p.p.m) followed by bacterial inoculation (30.35 p.p.m) and the lowest value (28.40 p.p.m) was under control treatment.

These results coincide with those obtained by **Kabesh et al. (1975)** and **Zaghloul et al. (1996 b)** who found that biofertilizer treatments gave higher values of available phosphorus in soil than uninoculated treatments.

8-Bacterial Counts:

Results in Table (5) showed that biological fertilizers under study caused an increase in number of azospirilla in the two growing seasons.

In the first season, the application of agrispon or bacterial inoculation either alone or with foliar application of agrispon increased number of azospirilla in the soil by 4.60, 12.24 and 12.37 x 10^5 g dry weight of soil over the control treatment, respectively. Whereas, the

corresponding increases in the second season were 0.44, 7.99 and 8.43 x 10^5 /g dry weight of soil, respectively.

It was clear that, there was no difference in azospirilla counts between bacterial inoculation alone or with agrispon treatments in both seasons.

Inoculation with azospirilla as well as azotobacter of maize plants resulted in a transitional increase in their densities at early stage of growth and the maximal N_2-use activities were observed during flowering and grain filling **(Hegazi et al, 1979)**. Also, **Monib et al. (1982)** found that application of a low dose of nitrogen, together with inoculation improved establishment of azospirilla. **Ishac et al.(1983)** found that greater numbers of Azotobacter. And Azospirillum spp were recorded from maize than that from wheat plants. **Pacovsky (1990)** showed that the number of inoculated Azospirillum brasilense cells per plant was correlated with percentage increase in dry weight or total N content relative to the N-fertilized plants.

Table (5): *Effect of Biological fertilizers on soil chemical and biological properties at harvest in 1995 and 1996 seasons.*

Characters / Seedbed preparation	pH	E.C. m.mhos/cm	Organic matter (%)	Total nitrogen (%)	Total phosphorus (%)	Avaliable nitrogen (p.p.m)	Avaliable phosphorus (p.p.m)	Bacterial counts (counts x10^5g dry weight of soil)
Season				**1995**				
Control (None)	7.83	1.14	2.11	0.18	0.48	48.76	27.56	21.66
Agrispon	7.81	1.13	2.12	0.20	0.51	49.98	28.78	26.26
Bacterial inoculation	7.78	1.18	2.17	0.19	0.53	49.08	27.86	33.90
Agrispon + bacterial inoculation	7.75	1.15	2.24	0.19	0.50	49.64	28.44	34.03
Season				**1996**				
Control (None)	7.85	1.19	2.20	0.19	0.50	48.44	28.84	27.83
Agrispon	7.81	1.21	2.21	0.19	0.50	50.24	30.64	28.27
Bacterial inoculation	7.83	1.18	2.25	0.19	0.52	49.95	30.35	35.82
Agrispon + bacterial inoculation	7.77	1.19	2.28	0.20	0.53	50.29	30.69	38.26

II-Emergence percentage and total weeds

A-Effect of seedbed preparation:

The effect of seedbed preparation on emergence percentage and weight of weeds are presented in Table (6).

1-Emergence percentage:

Table (6) shows the effect of seedbed preparation treatments on the mean values of emergence percentage of maize only in 1996 season.

The results revealed that the emergence percentage was differed significantly due to seedbed preparation treatments.

It is clear that the highest percentege 95.45 % was obtained after moldboard plow (once) + chisel plow (once), while the lowest one 82.02% was obtained after no-tillage treatment. On the other hand, no significant differences were found between moldboard plow (once) + chisel plow (once), moldboard plow (once) and chisel plow (twice) treactments.

These results are in line with those obtained by **Al-Darby (1986)**who found that the highest rate of maize emergance was ranked as the follow desigen: conventional moldboard tillage (CN) ; tillage plant (TP) ; chisel (CH) and no-tillage (NT)**Smith et al. (1992)** showed that no-tillage reduced maize emergence in all years by 8 to 20 % and delayed emergence by 1 to 11 days compared with conventional (mouldboard ploughing) tillage.

2-Fresh weight of weeds (g):

The major species accociated with maize during the two growing seasons were Amaranthus (Amaranthus paniculatus L.), Barmuda grass (Cynodon dactylon (L.) pers.) Pig weed (Amaranthus candatus L.), Lamp sequarters (Chenopodium album), Spiny cockelbure (Xanthium

Spinosum L.), Common purslane (Portulace oleraceae L.), Willd (Black nightshade) (Solanum nigrum), Nutgrass (Cyperus rotundus L.) and Link (Jungle rice) (Echinochola colcnum).

Results in Table (6) show the effect of seedbed preparation treatments on weed density in maize plots in 1995 season (at 60 and 90 days from planting) and in 1996 season (at 18 and 90 days from planting.

Data revealed that weed density expressed as fresh weight (g) was significantly affected by tillage practices at the respective sampling dates in both seasons.

In 1995 season, the greatest fresh weight was recorded in no-tillage (35.33 and 205.25 g at 60 and 90 days from planting) and the lowest ones were obtained with moldboard plow (once) + chisel plow (once) (23.58 and 134.17 g) for the two samples,respectively, No significant differences were observed between this treatment and moldboard plow (once)

Similar trend was obtained in the second season, the highest value of fresh weight of weeds was after no-tillage (30.42 and 216.42 g at 18 and 90 days from planting, respectively,) and the lowest value was after moldboard plow (once) + chisel plow (once) treatment (7.67 and 120.50 g and 18 and 90 days from planting, respectively). No significant differences were observed also between this treatment and moldboard plow (once).

3-Dry weight of weeds (g):

Results in Table (6) show that the dry weight of weeds was significantly reduced by plowing either by chisel or moldboard plow alone or together in both seasons and samples of experiment.

In 1995, weed dry weight decreased from (9.25 and 34.61 g) at no-tillage to (7.33 and 29.41 g), (6.75 and 28.45 g) (5.75 and 25.60 g) and

Table (6): *Effect of seedbed preparation on emergence percentage of maize, fresh and dry weight of weeds (gm) in 1995 and 1996 seasons.*

Characters / Seedbed preparation	Emergence Percentage		Fresh weight of weeds (gm /m²)		Dry weight of weeds (gm / m²)	
Season			***1995***			
Period			***At 60 days***	***At 90 days***	***At 60 days***	***At 90 days***
No – tillage	-		35.33 a	205.25 a	9.25 a	34.61 a
Chisel plow (once)	-		27.42 b	160.58 b	7.33 b	29.41 b
Chisel plow (twice)	-		26.58 b	159.50 b	6.75 bc	28.45 b
Moldboard plow (once)	-		24.58 b	142.50 c	5.75 c	25.60 c
Moldboard plow (once)+ chisel plow (once)	-		23.58 b	134.17 c	5.75 c	24.23 c
Season			***1996***			
Period			***At 18 days***	***At 90 days***	***At 18 days***	***At 90 days***
No – tillage	82.02	b	30.42 a	216.42 a	7.67 a	37.07 a
Chisel plow (once)	86.39	b	16.72 b	174.83 b	4.33 b	33.01 b
Chisel plow (twice)	91.97	ab	15.58 bc	151.17 c	3.67 b	24.45 c
Moldboard plow (once)	95.09	a	10.92 cd	123.33 d	3.33 b	23.67 d
Moldboard plow (once)+chisel plow (once)	95.45	a	7.67 d	120.50 d	2.83 b	23.57 d

(5.75 and 24.23 g) for the two samples after chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once) + chisel plow (once), respectively.

Similar trend was obtained in the second season, in this season the seedbed preparation treatments could be arranged according to their effect on weed dry weight as follows no-tillage (7.67 and 37.07 g), chisel plow (once) (4.33 and 33.01 g), chisel plow (twice) (3.67 and 24.45 g) moldboard plow (once) (3.33 and 23.67 g) and moldboard plow (once) + chisel plow (once) (2.83 and 23.57 g) at 60 and 90 days after sowing, respectively.

It could be concluded that all seedbed perapartion treatments were significantly superior in depressing weed growth compared with no-tillage treatment. The best tillage systems in reducing weeds were moldboard plow (once) + chisel plow (once) and moldboard plow (once), this could be due to the deeply buried weed seeds when using the moldboard which in turn reduced seed emergence of weeds.

These results are in agreement with those obtained by **Nassar (1992), Ball and Miller (1993), Gomaa and El-Naggar (1995 a), Gomaa and El-Naggar (1995 b), Gamaa (1996), and Shafshak et al (1996).**

B-Effect of biological fertilizers:

Results illustrated in Table (7) indicate the mean values of emergence percentage and weight of weeds as affected by biological fertilizer treatments.

1-Emergence percentage:

Emergence percentage of maize was recorded only in 1996 season and the results are shown in Table (7).

2-Fresh weight of weeds (g):

Table (7) shows the effect of biological fertilizers treatments on weed fresh weight at 60 and 90 days from planting (in the first season) and at 18 and 90 days from planting (in the second one).

Fresh weight of weeds was not significantly influenced by agrispon or bacterial inoculation in both seasons of the experiment.

In 1995 season, the fresh weight of weeds decreased by agrispon or bacterial inoculation at 60 and 90 days from sowing, whereas it increased by agrispon + bacterial inculation. However the differences in fresh weight of weeds were too slight to reach the level of significance at 5% level.

In 1996 season, both agrispon and bacterial inoculation increased weed fresh weight at 90 days when they were used alone or together. The differences between all used treatments were not significant (Tabl 7)

It could be concluded that neither agrispon nor bacterial inoculation significantly affected weed fresh weight.

3-Dry weight of weeds (g):

Similar trend was recorded regarding weed dry weight at 60 and 90 days in the first season as well as at 18 and 90 days in the second one. Dry weight of weeds was not significantly affected by biological fertilizers treatments.

In 1995 season, the dry weight of weeds decreased from (6.87 and 28.59 g) at 60 and 90 days from planting to (6.80 and 28.29) and (6.60 and 28.04) due to agrispon and bacterial inoculation respectively, compared with the control treatment.

The application of agrispon + bacterial inoculation increased weed dry weight compared with the control and each of agrispon and bacterial inoculation alone.

Table (7): *Effect of biological fertilizers on emergence percentage of maize, fresh and dry weight of weeds (gm) in 1995 and 1996 seasons:*

Characters / Seedbed preparation	Emergence Percentage	Fresh weight of weeds (gm / m²)		Dry weight of weeds (gm m²)	
Season		***1995***			
Period		***At 60 days***	***At 90 days***	***At 60 days***	***At 90 days***
Control (None)	-	27.40 a	160.40 a	6.87 a	28.59 a
Agrispon	-	27.20 a	160.67 a	6.80 a	28.29 a
Bacterial inoculation	-	26.33 a	159.93 a	6.60 a	28.04 a
Agrispon + bacterial inoculation	-	29.07 a	160.60 a	7.60 a	28.93 a
Season		***1996***			
Period		***At 18 days***	***At 90 days***	***At 18 days***	***At 90 days***
Control (None)	90.43	17.07 a	153.40 a	4.60 a	28.39 a
Agrispon	89.96	15.93 a	158.13 a	4.20 a	29.13 a
Bacterial inoculation	90.29	16.07 a	159.53 a	4.13 a	29.04 a
Agrispon + bacterial inoculation	90.07	16.00 a	157.93 a	4.53 a	30.05 a

In 1996 season, agrispon and bacterial inoculation either alone or in combination increased the dry weight of weeds at 90 days from sowing.

However the differences in weed dry weight between the biological fertilizers and the control was not significant.

C-Interaction effect:

Effect of the interaction between seedbed preparation and biological fertilizer treatments was significant only on fresh weigh of weeds at 60 days from sowing in the first season. Results presented in Table (8) revealed that the application of agrispon + bacterial inoculation gave the highest fresh weight of weeds in maize plots with no-tillage and that using moldboard plow. (once) + chisel plow (once) with agrispon + bacterial inoculation resulted in the lowest fresh weight of weeds.

It could be concluded that to reduce fresh weight of weeds to the minimum value, agrispon + bacterial inoculation is used after moldboard plow (once) + chisel plow (once).

The other characters i.e emergence percentage, fresh and dry weight of weeds at different period of plant growth were not significantly affected by the interaction between seedbed preparation and biological fertilizer treatments in both seasons. consequently, the data were excluded.

Table (8): *Interaction effect of the seedbed preparation and biological fertilizers on fresh weight (gm) of weeds at 60 days from planting in 1995 season:*

Seedbed preparation / *Fertilizers*	*No- tillage*	*Chisel plow (once)*	*Chisel plow (twice)*	*Moldboard plow (once)*	*Moldboard plow (once) + chisel plow (once)*
Period	*At 60 days from planting in 1995 season*				
Control (None)	32.00	26.33	28.67	24.37	25.67
Agrispon	33.33	26.00	28.33	23.67	24.67
Bacterial inoculation	33.67	24.00	25.67	25.00	23.33
Agrispon + bacterial inoculation	42.33	33.33	23.67	25.33	20.67
L.S.D at 5 %	**1.73**				

III-Growth characters

A-Effect of seedbed preparation

The effect of seedbed preparation on growth characters under study in the two growing seasons are presented in Table (9).

1-Plant height :

Plant height at 60, 75 and 90 days from planting in 1995 and 1996 seasons as affected by seedbed preparation are presented in Table (9).

Results clearly show that plant height at 60, 75 and 90 days from planting was significantly influenced by the different seedbed preparation treatments in both experimental seasons.

In the first season moldboard plow (once) + chisel plow (once) treatment resulted in taller plants (225.51, 259.06 and 262.93 cm), followed by that after chisel plow twice, (208.44, 247.76 and 252.15 cm) at 60, 75 and 90 days from planting, respectively whereas, the shortest ones (200.29, 234.60 and 237.60 cm) were obtained after no- tillage treatment. On the other hand, no significant difference was obtained in plant beight at 60, 75 and 90 days from planting between chisel plow (twice) and moldboard plow (once).

In the second season, the tallest plants (220.29, 260.73 and 263.44 cm) were obtained from moldboard plow (once) + chisel plow (once) treatment at 60, 75 and 90 days from planting, respectively. Whereas, the shortest plants (205.3, 243.86 and 246.29 cm) were obtained at no – tillage treatment, respetively for the three samples.

(123.79 and 125.11cm). The difference in ear height between these two treatments was significant in the two sampling dates.

It could be concluded that the ear height significantly increased by plowing with moldboard plow (once) + chisel plow (once) which gave the highest value of ear height in the two samples in both seasons of the experiment.

These results may be a consequence of raising the height of plant due to suitable seedbed preparation treatments.

3- Number of leaves / plant:

Number of leaves / plant at 60, 75 and 90 days from planting in the two growing seasons is presented in Table (9).

In 1995 season, results indicated clearly that there were significant differences between the average number of leaves/plant due to the five seedbed preparation treatments at 60 and 90 days from planting.

Moldboard plow (once) + chisel plow (once) treatment gave the highest number of leaves / plant which equal to 13.89, 14.87 and 14.33 leaves at 60, 75 and 90 days from planting, respectively, whereas the lowest ones (12.76, 14.34 and 13.64 leaves) were produced after no-tillage treatment at the respective sampling dates.

In 1996 season, results indicated that the seedbed preparation treatments had a significant effect on the number of leaves / plant only at the first sample (60 days). The mumber of leaves/plant at this period were 12.93, 12.99, 13.23, 13.39 and 13.91 leaves after chisel plow (once), no-tillage, chisel plow (twice), mddboard plow (once) and moldboard plow (once) + chisel plow (once), respectively.

At 75 and 90 days from planting seedbed preparation did not show any significant effect on number of leaves / plant as shown in Table (9).

The numbers of leaves/ plant at these two tested periods were (14.18, 13.55), (14.43, 13.61) (14.57, 13.71) (14.61, 13,93) and (14.78 , 14.09 leaves) after no- tillage, chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once) + chisel plow (once), respectively. However, the highest number of leaves per plant was recorded after moldboard plow (once) + chisel plow (once).

It could be concluded that plowing increased number of leaves / maize plant and that moldboard plow (once) + chisel plow (once) recorded the highest number of leaves / plant.

These results are in line with that reported by **Gupta et al. (1983) and Schaeler (1985).**

4-Stem diameter:

The results illustrated in Table (9) show the average values of stem diameter as affected by seedbed preapartion treatments at 60, 75 and 90 days from planting in 1995 and 1996 seasons.

Stem diameter was Significantly affected by seedbed preparation treatments in both seasons of the experiment .

In 1995 season, moldboard plow (once) + chisel plow (once) treatments gave the highest stem diameter at 60 days from planting with significant differences than the other applied treatments, whereas, no-tillage treatment gave the lowest value. On the other hand no significant difference was recorded between the means values of stem diameter at 60 days from planting after chisel plow (twice) and moldboard plow (once).

The seedbed preparation treatments could be arranged in a descending order regarding their effects on stem diamter at this stage as follows: moldboard plow (once) + chisel plow (once) (25.38mm), chisel plow (twice) (23.94mm), moldboard plow (once) (23.62mm), chisel plow (once) (22.85mm) and no-tillage (22.61mm).

Similar trend was obtained at second sample (75days) and third one (90days). The stem dimeter values were (23.22, 22.09mm), (23.67, 22.44mm), (24.69,23.61mm), (24.25, 23.34mm) and (26.06, 25.10mm) at 75 and 90 days, respectively, for no-tillage, chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once)+ chisel plow (once).

In the second season moldboard plow (once) + chisel plow (once) treatment resulted in maximum values of stem diameter (24.79, 25,52 and 24.21mm), respectively, at the three sampling dates, While the minimum ones were 22.78, 23.84 and 22.20 mm after no-tillage treatment, respectively, at 60 , 75 and 90 days from planting, respectively.

Similar results were also reported by **Pinar et al. (1993)** who reported that stalk thickness was affected by seedbed preparation compared with no-tillage.

5-Leaf area of topmost ear:

Results in Table (9) indicated significant differences in leaf area of the topmost ear among the seedbed preparation treatments in the two growing seasons. the highest leaf area of the topmost ear 695.19 and 715.42 cm^2 in 1995 and 1996 seasons, respectively, was obtained with moldboard plow (once) + chisel plow (once). On the other hand, zero tillage or chisel plow (once) produced the lowest leaf area of the topmost

Table (9): *Effect of seedbed preparation on some of growth maize characters at 60 , 75 and at 90 days from sowing in 1995 and 1996 seasons:*

Characters / Seedbed prepartion	Plant height (cm)	No.of leaves/ plant	Stem diameter (mm)	Plant height (cm)	Ear height (cm)	No. of leaves / plant	Stem diameter (mm)	Plant height (cm)	Ear height (cm)	No.of leaves/ plant	Stem diameter (mm)	Leaf area of topmost ear (cm^2)
Period	At 60 days			At 75 days				At 90 days				
Season	1995											
No. tillage	200.29 c	12.76 d	22.61 c	234.60 d	116.70 c	14.34 a	23.22 c	237.60 d	118.15 d	13.64 b	22.09 c	609.63 c
Chisel plow (once)	205.71 bc	12.91 cd	22.85 c	239.28 cd	119.34 c	14.39 a	23.67 c	243.01 cd	122.20 c	13.67 b	22.44 c	626.63 c
Chisel plow (twice)	208.44 b	13.33 b	23.94 b	247.76 b	125.09 b	14.49 a	24.69 b	252.15 b	129.02 b	13.81 b	23.61 b	666.64 b
Moldboard plow (once)	207.42 b	13.18 bc	23.62 b	244.18 bc	124.14 b	14.43 a	24.25 b	249.53 bc	127.80 b	13.85 b	23.34 b	651.49 b
Moldboard plow (once) + chisel plow (once)	225.51 a	13.89 a	25.38 a	259.06 a	133.79 a	14.87 a	26.06 a	262.93 a	136.82 a	14.33 a	25.10 a	695.19 a
Season	1996											
No- tillage	205.29 b	12.99 b	22.78 b	243.86 b	123.79 b	14.18 a	23.48 b	246.29 b	125.11 b	13.55 a	22.20 c	649.95 c
Chisel plow (once)	205.30 b	12.93 b	23.28 b	244.38 b	123.42 b	14.43 a	24.11 b	246.97 b	124.58 b	13.61 a	22.89 bc	649.61 c
Chisel plow (twice)	210.91 b	13.23 b	23.60 b	247.35 b	125.21 b	14.57 a	24.23 b	250.06 b	126.99 b	13.71 a	23.13 abc	677.12 b
Moldboard plow (once)	212.98 ab	13.39 b	23.70 b	249.94 b	127.14 b	14.61 a	24.36 b	252.90 b	129.16 b	13.93 a	23.35 ab	676.28 b
Moldboard plow (once)+ chisel plow (once)	220.29 a	13.91 a	24.79 a	260.73 a	132.64 a	14.78 a	25.52 a	263.44 a	133.99 a	14.09 a	24.21 a	715.42 a

ear in the two growing seasons. This increase in the leaf area with moldboard plow (once) + chisel plow (once) may be due to more availability of nutrients. These results are in good agreement with those obtained by **Al-Darby (1986) and Cox et al. (1990).**

6-Fresh weight of maize plant organs:

The fresh weight of maize plant organs as influenced by seedbed preparation at 60 and 90 days from sowing is presented in Table (10).

6-a-Leaves:

Fresh weight of maize leaves was significantly affected by seedbed preparation treatments at 60 and 90 days from sowing in both experimental seasons.

Fresh weight of leaves increased due to using different plows compared with no-tillage treatment

In 1995 season, seedbed preparation treatments could be arranged according to its effect on leaves fresh weight in a descending order as follows:

Moldboard plow (once) + chisel plow (once) (155.11 and 117.64 gm), chisel plow (twice) (147.22 and 115.03gm), moldboard plow (once) (142.06 and 113.33 gm), chisel plow (once) (131.06 and 109.78 gm) and no-tillage (124.15 and 106.78gm) at the two sampling dates, respectively.

In 1996 season, the highest fresh weight of maize leaves was obtained when moldboard plow (once) + chisel plow (once) treatment was used followed by moldboard plow (once) and chisel plow (twice) without significant differences between the three treatments, then chisel

plow (once), whereas, the lowest leaves fresh weight was recorded after no-tillage treatment. There were no significant difference between chisel plow (once) and no-tillage treatments.

The respective values of the five mentioned treatments at 60 and 90 days from sowing were: (154.08 and 119.81 gm.) (150.00 and 118.75 gm.), (149.57 and 116.39 gm.), (133.88 and 113.31 gm.) and (130.25 and 111.92 gm.).

It could be concluded that the fresh weight of leaves in maize plant was significantly increased by plowing and the highest fresh weight of leaves/plant was obtained by moldboard plow (once) + chisel plow (once).

These results agree with the finding of **Cox et al. (1990)** who found that the lower soil temperature under no-tillage resulted in lower leaf phytomass throughout the vegetative period of maize plants.

6-b-Stem + sheaths + tassel :

Results presented in Table (10) indicated that stem + sheaths + tassel fresh weight was significantly affected by seedbed preparation treatments at 60 and 90 days from sowing in the two successive seasons of 1995 and 1996.

In the first season the fresh weight of stem + sheaths + tassel increased significantly as a result of using chisel plow or moldboard plow or both of them together. The heaviest fresh weights of stem + sheaths + tassel (453.63 and 313.81 gm) were recorded when moldboard plow (once) + chisel plow (once) were used followed by that after chisel plow

(twice) (428.71 and 289.81gm) then moldboard plow (once) (415.61 and 285.97gm) then chisel plow (once (396.15 and 282.83 gm) at the two periods of growth, respectively. The lowest value was recorded after no-tillage treatment (378.10 and 272.03 gm) at 60 and 90 days from sowing, respectively.

In 1996 season similar result was noticed, the highest fresh weight of stem + sheaths + tassel / plant (462.06 and 316.75 gm) was obtained when maize plants were growing after moldboard plow (once) + chisel plow (once) followed by that after moldboard plow (once) (442.47 and 299.39 gm) then chisel plow (twice), (440.50 and 297.58 gm), then chisel plow (once) 406.44 and 286.5 gm. The lowest value was obtained by no-tillage treatment (397.75 and 276.68 gm).

It could be concluded that plowing significantly increased the fresh weight of maize plant and using moldboard plow (once)+ chisel plow (once) produced the highest fresh weight for maize plant.

The increase in fresh weight of maize plant due to plowing is mainly due to the increase in number of leaves / plant , plant height, stem diameter as well as leaf area (Table 10).

Similar conclusion was reported by **Cox et al. (1990)** who found that the lower soil temperature under no-tillage resulted in lower stem phytomass throughout the vegetative period of maize plants.

6-c-Ear:

The fresh weight of ear at 90 days after sowing as affected by seedbed preparation is shown in Table (10).

Ear fresh weight increased significantly due to seedbed preparation in both 1995 and 1996 seasons.

In 1995 season, chisel plow once or twice as well as moldboard plow once alone or accompanid with chisel plow caused a remarkable increas in ear fresh weight compared to no-tillage. These increases were 5.05, 16.33, 11.55 and 24.44 gm. for the four mentioned treatments, respectively, compared to no tillage without significant differences between chisel plow and moldboard one.

It could be concludod that the highest ear fresh weight was obtained by moldboard plow (once) + chisel plow (once) followed by chisel plow (twice) then moldboard plow (once) and chisel plow (once). The lowest value of ear fresh weight was after no-tillage.

In 1996 season, similar trend was obtained. The ear fresh weight values could be arranged in a descending order according to the plowing effect as follows: 307.00gm (moldboard plow (once) + chisel plow (once)) 296.17gm (moldboard plow (once)), 291.44gm (chisel plow (twice)), 284.61gm (chisel plow (once)) and 282.64 gm . (no-tillage).

The differences between chisel and moldboard plow were not significant.

It could be noticed that moldboard plow (once) + chisel plow (once) was superior of each of chisel or moldboard plow alone.

Results of the two seasons revealed that fresh weight of stem + sheaths + tassel was nearly equal to the ear fresh weight at 90 days after sowing.

This result confrims that of **Cox et al. (1990)** who observed that no-tillage had a lower kernel growth rate which resulted in lower kernel phytomass at physiological maturity.

7-Dry weight of maize plant organs:

Dry weight of maize plant organs as affected by seedbed preparation is presented in Table (10).

7-a-Leaves:

Results indicated that seedbed preparation treatments significantly increased maize leaves dry weight at 60 and 90 days after sowing in 1995 and 1996 seasons.

In the first season, moldboard plow (once) + chisel plow (once) gave the greatest dry weight of leaves (44.54 and 49.93 gm) followed by chisel plow (twice) (40.71 and 45.90gm), then moldboard plow (once) (39.01 and 45.99) whereas, chisel plow (once) was the lowest one (35.98 and 40.76 gm). The four plowing treatments significantly surpassed no-tillage treatment (32.77 and 37.78 gm) in dry weight of maize leaves at 60 and 90 days from sowing respectively (Table 10).

In the second season, the dry weight of leaves significantly increased by plowing compared with no-tillage treatment at 60 ang 90 days from sowing. The increases were (1.63 and 1.08), (5.90 and 5.69), (6.51 and 6.47) and (9.56 and 9.72 gm) after chisel plow (once), chisel plow (twice) moldboard plow (once) and moldboard plow (once) + chisel plow (once), respectively, as compared with no-tillage treatment.

It could be concluded that plowing either by chisel or moldboard plow alone or together increased the dry weight of maize leaves over the no-tillage treatment. The prefable treatment is moldboard plow (once) + chisel plow (once) to obtain the highest value of dry leaves weight.

Similar conclussion was achived by many investigators **Al-Darby (1986) Al-Darby and Lowery (1987), Cox et al. (1990) Hughes et al. (1992) and Nassar (1992).**

7-b-Stem + sheaths + tassel:

The dry weight of stem + sheaths + tassel increased significantly by seedbed preparation at 60 and 90 days after sowing in the two successive seasons of the study as shown in Table (10).

In 1995 season seedbed preparation treatment caused a considerable increase in stem + sheaths + tassel dry weight of maize plant. Using chisel plow (once) or twice and moldboard plow (once) alone or accompanied with chisel plow resulted in increases of (3.82 and 3.54), (12.99 and 10.90), (6.83 and 7.44) and (16.10 and 22.84 gm) at the two sampeling dates respectively over no tillage treatment.

Similar trend was recorded in 1996 season where the increases in stem + sheaths + tassel dry weight were (3.17 and 4.49), (10.85 and 10.68), (9.73 and 10.62) and (14.82 and 19.91gm). respectively for the four mentioned seedbed preparation treatments in comparison with the no-tillage treatment.

It could be concluded that the stem + sheaths + tassel dry weight in maize was positively influenced by seedbed preparation treatments and

that the highest value of dry weight was recorded when the soil was plowed by moldboard plow (once) + chisel plow (once) for each.

Some investigators came to similar conclussion, **Al-Darby (1986), Al-Darby and Lowery (1987) and Nassar (1992).**

7-c-Ear:

The ear dry weight of maize at 90 days after sowing was significantly increased by plowing treatments in both experimental seasons as illustrated in Table (10).

The ear dry weight raised from (91.33 and 97.37gm) at no-tillage to (93.87 and 100.11gm), (104.65 and 106.45gm), (102.11 and 111.13gm) and (121.07 and 120. 72 gm) as a result of using chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once) + chisel plow (once) in the first and second season respectively.

It is clear that using moldboard plow with chisel plow together produced the highest dry weight of ear followed by chisel plow (twice) or moldboard plow (once) without significant difference between them then chisel plow (once). The lowest ear dry weight was after no-tillage treatment.

These results are in line with those of **Al-Darby (1986), Al-Darby and Lowery (1987) and Nassar (1992).**

Table (10): *Effect of seedbed preparation on fresh and dry weight (gm) of maize plant organs (at 60 and 90 days from sowing) in 1995 and 1996 seasons.*

Characters / Seedbed preparation	Fresh weight (gm) / plant					Dry wight (gm) / plant				
	Leaves	*Stem + sheaths + tassel*	*Leaves*	*Stem + sheaths + tassel*	*Ear*	*Leaves*	*Stem + sheaths + teassel*	*Leaves*	*Stem + sheaths + teassel*	*Ear*
Period	*At 60 days*		*At 90 days*			*At 60 days*		*At 90 days*		
Season	**1995**									
No- tillage	124.15 e	378.10 e	106.78 c	272.03 d	273.59 c	32.77 e	72.68 e	37.78 d	64.43 e	91.33 c
Chisel plow (once)	131.06 d	396.15 d	109.78 bc	282.83 c	278.64 bc	35.98 d	76.50 d	40.76 c	67..97 d	93.87 c
Chisel plow (twice)	147.22 b	428.71 b	115.03 a	289.81 b	289.92 ab	40.71 b	85.67 b	45.90 b	75.33 b	104.65 b
Moldboard plow (once)	142.06 c	415.61 c	113.33 a	285.97 bc	285.14 bc	39.01 c	79.51 c	45.99 b	71.87 c	102.11 b
Moldboard plow (once) + chisel plow (once)	155.11 a	453.63 a	117.64 a	313.81 a	298.03 a	44.54 a	88.78 a	49.93 a	87.27 a	121.07 a
Season	**1996**									
No- tillage	130.25 b	397.75 c	111.92 c	276.68 c	282.64 b	36.35 c	78.07 d	41.12 c	68.21 d	97.34 d
Chisel plow (once)	133.88 b	406.44 c	113.31 bc	286.50 bc	284.61 b	37.98 c	81.24 c	42.20 c	72.70 c	100.11 cd
Chisel plow (twice)	149.57 a	440.50 b	116.39 abc	297.58 b	291.44 ab	42.25 b	88.92 b	46.81 b	78.89 b	106.45 bc
Moldboard plow (once)	150.00 a	442.47 b	118.75 ab	299.39 b	296.17 ab	42.86 b	87.80 b	47.59 b	78.83 b	111.13 b
Moldboard plow (once) + chisel plow (once)	154.08 a	462.06 a	119.81 a	316.75 a	307.00 a	45.91 a	92.89 a	50.84 a	87.12 a	120.72 a

days from sowing in both seasons of the experiment.

In 1995, season agrispon alone or combined with bacterial inoculation increased ear height, but this increase was too slight to reach the level of significance at the two sampling dates.

Similar trend was noticed in the second season, where ear height increased when agrispon or bacterial inoculation was used compard with the control treatment at the two sampling times.

It is clear that ear height in maize was not significantly affected by agrispon or bacterial inoculation.

These results are in line with those of **Mahgoub et al. (1991) and El-Gezawy (1996).**

3-Number of leaves / plant:

Table (11) shows that the number of leaves / plant was not significantly affected by biological fertilizer treatments at the three sampling dates in the two expenimental seasons.

Number of leaves per maize plant did not significantly differ due to agrispon or bacterial inoculation at 60, 75 and 90 days from sowing through the two seasons of experiment.

It could be concluded that number of leaves of maize plant was not affected by agrispon or bacterial inoculation and this result is mainly because the number of leaves in maize is genetical character.

This result agrees with those of **El-Gezawy (1996).**

4-Stem diameter:

Stem diameter of maize as influenced by agrispon, bacterial inoculation and agrispon + bacterial inoculation at 60, 75, and 90 days from sowing is illustrated in Table (11).

Results show that the three biological fertilizer treatments did not significantly affect maize stem dimeter through the three stages of growth in the two successive seasons of study.

In the first season, the highest value of maize stem diameter (23.85, 24.56 and 23.53 mm) was recorded by bacterial inoculation followed by agrispon application (23.71, 24.45, and 23.40mm) then agrispon + bacterial inoculation (23.65, 24.40 and 23.39mm) and the lowest value was for the control treatment (23.51, 24.09 and 22.95mm) at the three sampling dates respectively.

In 1996 season, agrispon gave the highest value of stem diameter (23.91, 24.62 and 23.50mm) followed by agrispon + bacterial inoculation (23.68, 24.31 and 23.08mm) The lowest value was recorded by bacterial inoculation at 60 and 75 days after sowing or control treatment at 90 days after sowing.

It could be concluded that agrispon and bacterial inoculation gave the highest value of stem diameter in 1995 and 1996 season, respectively without significant differences between the biological fertilizer treatments and the control one.

Similar conclussion was recorded by **El-Gezawy (1996) and Hassanein et al. (1997).**

Table (11): *Effect of biological fertilizers on some growth characters of maize at 60,75 and 90 days from sowing in 1995 and 1996 seasons.*

Characters / Seedbed prepartion	Plant height (cm)	No.of leaves/ plant	Stem diameter (mm)	Plant height (cm)	Ear height (cm)	No. of leaves / plant	Stem diameter (mm)	Plant height (cm)	Ear height (cm)	No.of leaves/ plant	Stem diameter (mm)	Leaf area of topmost ear (cm^2)
Poriod	At 60 days			At 75 days				At 90 days				
Season	**1995**											
Control (None)	208.32 a	13.08 a	23.51 a	243.00 a	122.11 a	14.51 a	24.09 a	248.04	125.83 a	13.88 a	22.95 a	636.92 a
Agrispon	209.82 a	13.22 a	23.71 a	246.08 a	125.57 a	14.49 a	24.45 a	249.36	128.26 a	13.83 a	23.40 a	649.99 a
Bacterial inoculation	207.95 a	13.17 a	23.85 a	244.76 a	122.55 a	14.48 a	24.56 a	249.62	125.34 a	13.87 a	23.53 a	656.48 a
Agrispon + bacterial inoculation	210.21 a	13.35 a	23.65 a	246.06 a	125.03 a	14.54 a	24.40 a	249.16	128.05 a	13.87 a	23.39 a	656.27 a
Season	**1996**											
Control (None)	210.52 a	13.24 a	23.52 a	249.33 a	126.10 a	14.52 a	24.30 a	252.03 a	127.48 a	13.80 a	22.98 a	667.58 a
Agrispon	211.27 a	13.35 a	23.91 a	248.94 a	127.42 a	14.48 a	24.62 a	252.04 a	129.44 a	13.83 a	23.50 a	673.38 a
Bacterial inoculation	212.41 a	13.34 a	23.41 a	248.55 a	126.46 a	14.61 a	24.13 a	251.87 a	128.10 a	13.74 a	23.07 a	681.45 a
Agrispon + bacterial inoculation	209.46 a	13.24 a	23.68 a	250.19 a	125.79 a	14.44 a	24.31 a	251.79 a	126.86 a	13.75 a	23.08 a	672.29 a

5-Leaf area of the topmost:

It was clear that the differences between the mean values of leaf area of the topmost ear were not significantly affected by different fertilizeres in both seasons (Table11). The highest values of leaf area (656.48 and 681.45 cm^2) was obtained from bacterial inoculation in the first and second seasons, respectively. Whereas, the lowest one (636.92 and 667.58 cm^2) was produced from the control treatment in 1995 and 1996 seasons, respectively. Similar trend was obtained by **El-Gezawy (1996)** who found that agrispon spraying did not significantly affect ear leaf area in both seasons. Also, **Hassanein et al (1997)** found that inoculation of Zea mays with fixing bacteria had no significant effects on leaf area.

6-Fresh weight of maize plant organs:

The fresh weight of maize plant organs at 60 and 90 days after sowing as affected by biological fertilizer treatments is presented in Table (12).

6-a-Leaves :

Fresh weight of leaves at 60 after sowing increased significantly by agrispon, bacterial inoculation compared to control treatment in both seasons and at 90 days from sowing in first one. (Table 12)

In 1995 season, the increases in fresh weight of leaves were (3.35 and 0.84), (2.80 and 1.53) and (6.25 and 5.88 gm) at 60 and 90 days after sowing, respectively, by agrispon, bacterial inoculation and agrispon + bacterial inoculation respectively, over the control treatment without

significant differences between control and each of agrispon and bacterial inoculation.

In 1996 season, agrispon, bacterial inoculation and the combination of them caused an increases of (2.00 and 5.00), (2.45 and 2.91) and (4.37 and 2.00 gm) at 60 and 90 days after sowing, respectively, over the control treatment. The differences was significant only between agrispon + bacterial inoculation and control at 60 days and between agrispon and control at 90 days from sowing.

It could be concluded that the application of agrispon combined with bacterial inoculation significantly increased leaves fresh weight of maize over the control treatments at 60 and 90 days after sowing. **El-Gezawy (1996)** found that agrispon spraying did not significantly affect leaves fresh weight of maize plant.

6-b-Stem + sheaths + tessel:

The fresh weight of stem + sheaths + tassel of maize was not significantly affected by biological fertilizer treatments at 60 and 90 days after sowing in both 1995 and 1996 seasons.

In 1995 season each of agrispon or bacterial inoculation alone or togther caused too slight increase in stem + sheaths + tassel fresh weight. Similar trend was recorded in 1996 season.

It could be concluded that biological fertilizers did not significantly affect the fresh weight of stem + sheaths + tassel in maize plants.

Similar results was recorded by **El-Gezawy (1996).** On the other hand, **Kapulnik et al. (1981)** observed that shoot weight was significantly increased in the inoculated plants.

6-c-Ear:

The ear fresh weight of maize at 90 days after sowing was not significantly affected by agrispon, bacterial inoculation and the two fertilizers together in both experimental seasons.

In 1995 season, slight insignificant increases in maize ear fresh weight were recorded as a result of agrispon, bacterial inoculation and the combination of them as compared to control treatment.

Similar trend was obtained in the second season where the differences in ear fresh weight were too slight to reash the level of significance.

This result is in harmony with this obtained by **El-Gezawy (1996).**

7-Dry weight of maize plant organs:

The dry weight of maize plant organs, namely, leaves, stem + sheaths + tassel at 60 and 90 days after sowing as well as dry weight of ear at 90 days after sowing as influenced by biological fertilizer treatments are presented in Table (12).

Only the leaves dry weight at 60 days after sowing in the first season was significantly influenced by biological fertilizer treatments.

7-a-leaves:

Results in Table (12) show that biological fertilizer treatments significantly increased the dry weight of leaves in maize plant at 60 days

after sowing in the first season only without significant difference between agrispon and control or bacterial inoculation. Also the difference between bacterial inoculation alone or combined with agrispon was not significant. However, in the first season, the increases in leaves dry weight / plant were 1.04, 1.51 and 2.38 gm for agrispon, bacterial inoculation and agrispon + bacterial inoculation, respectively, compared to the control treatment. The dry weight of leaves at 90 days after sowing did not significantly differ due to biological fertilizer treatments.

In 1996 season, the increases in leaves dry weight at 60 and 90 days after sowing were too slight to reach the level of significance. Similar results were obtained by **Reiad et al. (1987) and El-Gezawy (1996)**. On the other hand **Nur et al. (1980), Lee et al. (1989)** and **Weddad (1990)** found a considerable increase in dry matter / plant by inoculation of maize plants with azospirilla.

7-b-Stem + sheaths + tassel :

Results in Table (12) indicated that biological fertilizer treatments did not show any significant increase in stem + sheaths + tassel dry weight at 60 or 90 days after sowing in the two successive seasons of the experiment.

It could be concluded that neither agrispon nor bacterial inoculation alone or in combination caused significant increase in dry weight of stem + sheaths + tassel.

Table (12): *Effect of biological fertilizers on fresh and dry weight (gm) of maize plant organs at 60 and 90 days from sowing in 1995 and 1996 seasons.*

Characters / Fertilizers	Fresh weight (gm) / plant					Dry wieght (gm) / plant				
	Leaves	*Stem + sheaths + tassel*	*Leaves*	*Stem + sheaths + tassel*	*Ear*	*Leaves*	*Stem+ sheaths + tassel*	*Leaves*	*Stem + Sheaths + tassel*	*Ear*
Period	*At 60 days*		*At 90 days*			*At 60 days*		*At 90 days*		
Season	**1995**									
Control (None)	136.82 b	409.97 a	110.45 b	286.00 a	280.53 a	37. 37 c	80.07 a	44.12 a	72.49 a	100.33 a
Agrispon	140.17 ab	418.65 a	111.29 b	290.09 a	286.65 a	38.41 bc	80.92 a	44.87 a	74.14 a	102.37 a
Bacterial inoculation	139.62 ab	412.55 a	111.98 b	289.31 a	284.98 a	38. 88 ab	80.71 a	43.73 a	73.02 a	103.93 a
Agrispon + bacterial inoculation	143.07 a	416.58 a	116.33 a	291.16 a	288.09 a	39.75 a	80.81 a	43.57 a	73.85 a	103.80 a
Season	**1996**									
Control (None)	141.35 b	428.13 a	113.56 b	293.22 a	290.56 a	40.59 a	85.18 a	44.85 a	76.14 a	105.45 a
Agrispon	143.35 ab	428.84 a	118.56 a	296.09 a	293.20 a	40.89 a	85.72 a	46.57 a	77.02 a	108 .49 a
Bacterial inoculation	143.80 ab	432.89 a	116.47 ab	295.69 a	293.04 a	41.29 a	85.87 a	46.09 a	77.76 a	107.14 a
Agrispon + bacterial inoculation	145.72 a	429.51 a	115.56 ab	296.04 a	292.69 a	41.51 a	86.37 a	45.34 a	77.67 a	107.53 a

Many investigators came to similar conclussion **Reiad et al. (1987) and El-Gezawy (1996)**. Other researchers such as **Nur et al. (1980), Lee et al. (1989) and Wedad (1990)** found that inoculation of maize with azospirilla increased plant dry matter.

7-c-Ear:

Dry weight of ear in maize plant at 90 days after sowing was not significantly influenced by agrispon or bacterial inoculation alone or together in both experimental seasons.

In 1995 season, the ear weight increased from 100.33 gm to 102.37, 103.93 and 103.80gm respectively for agrispon, bacterial inoiulation and agrispon + bacterial inoculation, respectively.

In 1996 season, the respective increases were, 3.04, 1.69 and 2.08gm. for the three biological fertilizer treatments compared with the control treatment.

It could be concluded that agrispon and bacterial inoculation did not significantly affect ear dry weight of maize when applied alone or combined.This result confirms this obtained by **El-Gezawy (1996)**.

C-Interaction effect:

The effect of the interaction between seedbed preparation and biological fertilizers was not significant for all studied characters of growth in both seasons, except ear height at 75 days from sowing and dry weight of stem + sheaths + tassel per plant at 60 days from sowing in the first season only. Consequently, the data were excluded.

1-Effect of the interaction on ear height:

Interaction effect of seedbed preparation and biological fertilizers was significant only on ear height of maize at 75 days from planting in 1995 season as shown in Table (13).

It was clear that bacterial inoculation after no-tillage gave the lowest ear height of maize (113 cm), whereas, the highest value (140 38 cm) was obtained by foliar application of agrispon after moldboard plow (once) + chisel plow (once).

2-Effect of the interaction on dry weight of stem + sheaths + tassel per plant:

The mean values of stem + sheaths + tassel dry weight of maize plant at 60 days after planting was significantly affected by the interaction between seedbed preparation and biological fertilizer treatments in 1995 season as shown in Table (14).

The highest value (90.99 g) was obtained by foliar application of agrispon after moldboard plow (once) + chisel plow (once). Whereas agrispon with no-tillage gave the lowest value (70.98 g). On the other hand, no significant difference was obtained between the interaction of moldboard plow (once) + chisel plow (once) with different biological fertilizer on dry weight of stem + sheaths + tassel per plant. Also, the interaction between no-tillage and foliar application of agrispon or bacterial inoculation was not significant on dry weight.

Table (13): *Interaction effect of seedbed preparation and biological fertilizers on Ear height (cm) plants at 75 days from planting in 1995 season.*

Seedbed preparation / Fertilizers	No- tillage	Chisel plow (once)	Chisel plow (twice)	Moldboard plow (once)	Moldboard plow (once) + chisel plow (once)
Season			**1995**		
Control (None)	115.88	117.93	121.38	124.13	131.25
Agrispon	115.90	117.60	129.35	124.63	140.38
Bacterial inoculation	113.00	120.65	125.63	121.78	131.68
Agrispon + bacterial inoculation	122.00	121.20	124.00	126.05	131.88
L.S.D at 5 %	**4.86**				

Table (14): *Interaction effect of the seedbed preparation and biological fertilizers on dry weight (gm) of stem + sheaths + tassel of maize plant at 60 day from planting in 1995 season.*

Seedbed preparation / *Fertilizers*	*No- tillage*	*Chisel plow (once)*	*Chisel plow (twice)*	*Moldboard plow (once)*	*Moldboard plow (once) + chisel plow(once)*
Season			***1995***		
Control (None)	71.29	74.10	89.90	78.40	86.66
Agrispon	70.98	76.67	85.54	80.45	90.99
Bacterial inoculation	74.36	77.87	83.16	78.47	89.69
Agrispon + bacterial inoculation	74.08	77.35	84.10	80.72	87.78
L.S.D at 5 %			**3.78**		

V- Photosynthesis pigments

A-Effect of seedbed preparation:

Results in Table (15) show that seedbed preparation treatments had no significant effect on chlorophyll a, "a+b" and carotenoides in 1995 and 1996 seasons, whereas, chlorophyll "b" was significantly increased by using seedbed preparation treatments in 1996 season only.

Moldboard plow (once) + chisel plow (once) was more effective than the other treatmants in increasing chlorophyll "b" in ear leaves of maize at 90 days after sowing (4.004 mg / gm) in the second season only, but no-tillage (control) gave the lowest one (3.603 mg/ gm). On the other hand, no significant difference was obtained between moldboard plow (once) + chisel plow (once) and the other treatments as compared with the control treatment.

In general, moldboard plow (once) + chisel plow (once) gave the maximum mean values of chlorophyll "a" , "b", "a + b" and carotenoids in the second season.

It could be concluded that chorophyll content in leaves was highly correlated with leaf area but not with dry matter as affected by seedbed preparation. **Cox et al. (1990)** indicated that the lower soil temperature under no-tillage resulted in lower leaf, stem and total phytomass throughout the vegetative periods of maize plants.

Table (15): *Effect of seedbed preparation on photosynthesis pigments content of maize in 1995 and 1996 seasons.*

Characters / Seedbed preparation	Chlorophyll mg/gm "a"	Chlorophyll mg/ gm "b"	Chlorophyll mg/gm "a+b"	Carotenoids mg/ gm
Season		**1995**		
No – tillage	5.524 a	3.525 a	9.050 a	2.328 a
Chisel plow (once)	5.713 a	3.543 a	9.256 a	2.422 a
Chisel plow (twice)	5.903 a	3.586 a	9.489 a	2.457 a
Moldboard plow (once)	5.899 a	3.681 a	9.581 a	2.412 a
Moldboard plow + chisel plow (once)	5.963 a	3.631 a	9.595 a	2.479 a
Season		**1996**		
No – tillage	5.615 a	3.603 b	9.217 a	2.483 a
Chisel plow (once)	5.747 a	3.738 ab	9.485 a	2.590 a
Chisel plow (twice)	5.845 a	3.901 a	9.746 a	2.525 a
Moldboard plow (once)	5.922 a	3.962 a	9.884 a	2.581 a
Moldboard plow + chisel plow (once)	6.013 a	4.004 a	10.019 a	2.618 a

B-Effect of biological fertilizers:

It was evident from Table (16) that there was no significant difference beween agrispon spragying and bacterial inoculation as compared with the control treatment in chorophyll "a" , chlorophyll "b" and chlorophyll "a+b" content in the two growing season, whereas, carotenoids content was significantly affected by agrispon sprayging with bacterial inoculation as compared with the other treatments of fertilizer in the first season only.

Agrispon spraying with bacterial inoculation produced the maximum values of chorophyll "a", chorophyll "b" , and total chorophyll (5.940, 3.71 and 9.702 mg / gm , respectively) in the first seasons. On the other hand, bacterial inoculation alone gave the maximum values of chlorophyll "a", chlorophyll "b" and total chlorophyll which were 5.875 , 3.883 and 9.726 mg / gm , respectively in the second season. All increases were, however below the 5% level of significance.

The highest values of carotenoids content (2.581 mg / gm) was produced from agrispon spraying with bacterial inoculation in the first season. However spraying of agrispon alone gave the maximum value of carotenoids content (2.676 mg / gm) in the second season.

These results are in harmony with those obtained by **Tilak et al. (1982) and El-Gezawy (1990)** who concluded that agrispon spraying or bacterial inoculation showed no significant effect on pigments content in maize ear leaf.

Table (16): *Effect of biological fertilizer on photosynthesis pigments centent of maize in 1995 and 1996 seasons.*

Characters / *Seedbed preparation*	*Chlorophyll mg/gm "a"*	*Chlorophyll mg/ gm "b"*	*Chlorophyll mg/gm "a+b"*	*Carotenoids mg/ gm*
Season		**1995**		
Contorl (None)	5.597 a	3.520 a	9.122 a	2.410 b
Agrispon	5.882 a	3.552 a	9.374 a	2.330 b
Bacterial inoculation	5.842 a	3.534 a	9.374 a	2.357 b
Agrispon + bacterial inoculation	5.940 a	3.761 a	9.702 a	2.581 a
Season		**1996**		
Contorl (None)	5.783 a	3.581 a	9.666 a	2.513 a
Agrispon	5.844 a	3.763 a	9.713 a	2.676 a
Bacterial inoculation	5.875 a	3.883 a	9.726 a	2.569 a
Agrispon + bacterial inoculation	5.812 a	3.869 a	9.576 a	2.479 a

IV-Flowering and fertility of maize plants

A-Effect of seedbed preparation:

The effect of seedbed preparation on flowering and fertility of maize plants is presented in Table (17).

1-Time of tassling and silking:

The results show that the average values of number of days to 50% tasseling and silking were significantly decreased by using seedbed preparation in one season out of two (Table 17).

In 1995 season, moldboard plow (once) + chisel plow (once) gave the earliest tasseling and silking (63.38 and 67 . 63 days from sowing), respectively, in maize compared with no- tillage (66.81 and 70.44 days from sowing), respectively. Whereas, no significant differences were observed between the control treatment and the other treatments (chisel plow (twice), mold board plow (once) and chisel plow (once).

In 1996 season, no significant differences among the seedbed preparation treatments were obtained in number of days from planting to 50% tasseling and silking. The earliest tasseling and sikling were achieved by once moldboard plow + once chisel plow (64.25 and 69.06 days from sowing , respectively).

It was evident that the shortest period at 50% tasseling and sillking produced from moldboard plow (once) + chisel plow (once) may be due to increasing available nitrogen in the soil under this treatment.

Nitrogen encourages the meristematic activity and increase the vegetative growth which puch maize plants towards the earlier tasseling

and silking. Similar results were obtained by **Al-Darby and Lowery (1984) Al-Darby (1986), Hesterman et al. (1988), Conti et al. (1990), Kasper et al (1990),Smith et al. (1992) and Vyn and Raimbault (1992).**

2-Barren plants percentage:

It was observed from Table (17) that the percentage of barren plants was significantly affected by seedbed preparation in 1995 and 1996 seasons. No-tillage gave the highest percentage of barren plants (7.32 and 7.21%) in the first and second seasons, respectively. However, the lowest percentage (5.93 and 5.71% in 1995 and 1996 seasons, respectively) was produced from moldboard plow (once) + chisel plow (once). On the other hand, there was no significant difference between moldboard plow (once) + chisel plow (once) and the other treatments of seedbed preparation in barren plants percentage.

It could be concluded that seedbed preparation was satisfactory to reduce the percentage of barren plants of maize.

3-Percentage of plants carrying one or more than one ear:

The results illustrated in Table (17) show that the percentage of plants carrying one or more than one ear was significantly affected by seedbed preparation in both seasons.

It was clear that moldboard plow (once) + chisel plow (once) gave the lowest percentage of plants carrying one ear (85.18 and 84.51%) and the highest percentage of plants which carried more than one ear (8.89 and 9.79%) in 1995 and 1996 seasons, respectively. On the contrary, no-

Table (17): *Effect of seedbed preparation on the flowering and fertility of maize plants in 1995 and 1996 seasons.*

Characters / Seedbed preparation	Time of tasseling (days)	Time of silking (days)	Barren plant (%)	Plant carring one ear (%)	Plant carring more than one ear (%)
Season			**1995**		
No – tillage	66.81 a	70.44 a	7.32 a	88.42 a	4.26 d
Chisel plow (once)	66.75 a	70.24 a	6.50 abc	88.06 a	5.44 c
Chisel plow (twice)	66.31 a	70.06 a	6.34 bc	88.04 a	5.59 c
Moldboard plow (once)	66.38 a	69.81 a	7.23 ab	88.25 b	6.51 b
Moldboard plow (once) + chisel plow (once)	63.38 b	67.63 b	5.93 c	85.18 c	8.89 a
Season			**1996**		
No – tillage	65.81 a	69.69 a	7.21 a	87.60 a	5.20 d
Chisel plow (once)	65.31 a	69.13 a	5.77 c	87.80 a	6.43 c
Chisel plow (twice)	65.38 a	69.44 a	5.91 bc	87.62 a	6.47 c
Moldboard plow (once)	65.50 a	69.19 a	6.28 b	86.00 b	7.72 b
Moldboard plow (once) + chisel plow (once)	64.25 a	69.06 a	5.71 c	84.51 c	9.79 a

tillage produced the highest percentage of plants which carried one ear and the lowest percentage of plants which carried more than one ear. These results are expected because the percentage of barren plants became higher in the control treatment (no-tillage). These results are in fit with the results obtained by **Nasser (1992)** who found that conventional tillage system had a signifieant effect on number of ears per plant than no-tillage system.

B-Effect of biological fertilizers:

The effect of biological fertilizers on flowering and fertility of maize plants is shown in Table (18).

1-Time of tasseling and silking:

Results in Table (18) show that tasseling and silking dates were not significantly affected by bacterial inoculation or agrispon spraying as compared to the control treatments in both seasons. This might indicate that the population of bacteria that already existed in the soil was so high that it minimized the differences that might have been existed among bacterial inoculation treatments.

The same trend was obtained by **Mahgoub et al (1991)** and **El-Gezawy (1996)** who found that agrispon spraying or inoculation with bacteria did not significantly affect tasseling and silking dates.

2-Barren plants percentage:

It was observed from the results in Table (18) that the percentage of barren plants was not significantly affected by using of agrispon spraying or bacterial inoculation as compared to the control treatment in

the two growing seasons. These results are in fit with the results obtained by **El-Borollesy et al. (1986), Mahgoub et al. (1991), Abd El-Gawad et al. (1995), El-Gezawy (1996), Terry et al. (1996) and Hassanein et al. (1997).**

3-Percentage of plants carrying one or more than one ear:

It is clear from results that biological fertilizer had no significant effect on the percentage of plants carrying one ear in both seasons, whereas, the percentage of plants carrying more than one ear was significantly affected by biological fertilizer in one season out of two (Table 18).

The difference among the percentage of plants carrying one ear was too small to reach the 5% level of significance due to biological fertilizer in both seasons.

Foliar application of agrispon with bacterial inoculation gave the highest percentage of plants carrying more than one ear (6.86 and 7.34 %) in the first and second seasons, respectively. On the other hand, the lowest percentage (5.89 and 6.86 %) was obtained from the control treatment (uninoculation with cerialin and without foliar application of agrispon) in 1995 and 1996 seasons, respectively. These results are expected because the percentage of barren plants became higher in the control treatment.

Similar results were obtained by **Reiad et al. (1987) Abd – El-Gawad et al. (1995), El-Gezawy (1996) and Hassanien et al. (1997).**

Table (18): *Effect of biological fertilizers on flowering and fertility maize in 1995 and 1996 seasons.*

Characters / Fertilizers	Time of tasseling (days)	Time of silking (days)	Barren plant (%)	Plant carring one ear (%)	Plant carring more than one ear (%)
Season			**1995**		
Control (None)	66.30 a	69.80 a	6.71 a	87.40 a	5.89 a
Agrispon	66.00 a	69.50 a	6.85 a	87.38 a	5.78 a
Bacterial inoculation	65.75 a	69.65 a	6.69 a	87.29 a	6.02 a
Agrispon + bacterial inoculation	65.65 a	69.60 a	6.42 a	86.70 a	6.86 b
Season			**1996**		
Control (None)	64.85 a	69.10 a	6.28 a	86.86 a	6.86 a
Agrispon	65.35 a	69.65 a	6.14 a	86.72 a	7.14 a
Bacterial inoculation	65.35 a	68.85 a	6.11 a	86.66 a	7.23 a
Agrispon + bacterial inoculation	65.45 a	69.60 a	6.19 a	86.58 a	7.34 a

IIV- YIELD AND ITS COMPONENTS

A-Effect of seedbed preparation:

The average values of yield and its components characters as affected by seedbed preparation in the two groing seasons are presented in Tables (19 and 20).

1-Length and diameter of ear:

The effect of seedbed preparation on the mean values of ear length and ear diameter was significant in both seasons as shown in Table (19).

In the first season, the largest value of ear length and maximum value of ear diameter (18.82 cm and 46.89 mm) were recorded with moldboard plow (once) + chisel plow (once), respectively, whereas the lowest values of length and diameter of ear (16.34 cm and 44.34 mm, respectively) were obtained from no-tillage with no significant difference between chisel plow (once) and no-tillage. Also, no significant difference was found between chisel plow (twice) and moldboard plow (once) in the above traits.

In the second season, the longest ear (18.24 cm) was obtained from moldboard plow (once) + chisel plow (once). Moldboard plow (once) gave the maximum mean value of ear diameter (46.36 mm), whereas, no signifcant difference was detected on length and diameter of ear between moldboard plow (once) and moldboard plow (once) + chisel plow (once). On the contrary, no-tillage gave the minimum length and diameter of ear (16.57 cm and 44.88 mm, respectively).

The better length and diameter of ear associated with seedbed preparation may be ascribed to the soil structure improvement which contribute more available nutrients to the plant and this in turn encourage the vegetative growth of maize plants. These results are in accordance with those obtained by **Hargrove (1985).**

2-Number of rows per ear:

The results collected in Table (19) show that number of rows per ear was significantly affected by seedbed preparation treatments in the two seasons of study.

The highest number of rows / ear (14.11) was produced from moldboard plow (once)+ chisel plow (once) in 1995 season, whereas moldboard plow (once) gave the highest number of rows/ ear (14.24) in 1996 season. On the other hand, the lowest ones (13.43 and 13.56) were obtained from no-tillage in the first and second seasons, respectively. It was clear that the increase in number of rows per ear resulted from the increase in diameter of ear. Also, the number of rows/ ear is mainly controlled more by the genetical factors of the plants than the environmental ones.

It could be concluded that plowing either by chisel or moldboard plow alone or together increased the number of rows per ear of maize over that of no-tillage treatments and that the highest number of rows was realized after chisel plow (once) + moldboard plow (once).

3-Number of grains per row and per ear:

The results in Table (19) indicate that the mean values of the number of grains per row and ear was significantly affected by seedbed preparation treatments in 1995 and 1996 seasons.

The maximum value of number of grains per row (39.41 and 39.06, grain) was obtained when moldboard plow (once) + chisel plow (once) were used in the first and second season, respectively. The greatest number of grains/ear (555.15 and 553.01 grain) was obtained from moldboard plow (once) + chisel plow (once) in 1995 and 1996 seasons, respectively. On the other hand, no-tillage treatment gave the minimum number of grains per row and per ear in both seasons. It was clear that the increase in the number of grains per ear resulted from the increase in length and diameter of ear and number of grains per row as affected by seedbed preparation.

It could be noticed that moldboard plow (once)+ chisel plow (once) was superior to the other treatments of seedbed preparation in increasing the number of grains per row and ear of maize. Similar result was obtained by **Salim and El-Sergany (1995)** whc revealed clearly that conventional tillage system significantly increased the average number of grains / row as compared to no-tillage system in one season out of two.

4-Ear weight and grain weight per ear:

The mean values of ear weight and grain weight per ear were significantly increased by using seedbed preparation as compared with no-tillage (control) in both seasons as presented in Table (19).

The superior treatment was that of moldboard plow (once) + chisel plow (once) followed by moldboard plow (once) and chisel plow (twice) as compared with no-tillage and chisel plow (once). Whereas, no-tillage treatment gave the lowest values of ear weight and grain weight per ear in the two growing seasons. On the other hand, no significant difference was found between no-tillage and chisel plow (once) in these traits in both seasons. These results may be due to that moldboard plow improved the physical properties of the soil and this in turn positively affected growth and yield through improving soil porosity and water holding capacity of the soil as well as improving soil drainage and soil aeration **(Shafahak et al., 1996)**. It was clear that the increase in ear weight and grain weight per ear due to the increase in length and diameter of ear, 100 – kernel weight, number of grains/ear shelling perecentage. Similar results were obtained by **Knavel et al., (1985)**.

5-100-grain weight:

The effect of seedbed preparation treatments on the mean values of 100-grain weight was significant in 1995 and 1996 seasons as tabulated in Table (19). However, no significant difference was obtained between moldboard plow (once) + chisel plow (once), moldboard plow (once) and chisel plow (twice). Moldboard plow (once) + chisel plow (once) gave the maximum value of 100-grain weight (33 and 33.13 gm) in the first and second seasons, respectively. Whereas, no-tillage and chisel plow (once) treatments gave the minimum weight of 100-grain weight (30.65 and 30.77 gm) in the first season as well as (30.67 and 30.54 g) in the second one, respectively.

It could be concluded that all seedbed preparation treatments under study except chisel plow (once) were more effective in increasing 100 – grain weight and this may be due to availability of nutrients which contribute to increase amounts of photosynthetic accumulation by plants to which the dry matter content is a reliable index and this in turn might account much for the superiority of 100 – grain weight.

Similar results were reported by **Nassar (1992)** who found that conventional tillage system had a significant effect on 100 – grain weight than no-tillage system.

6-Shelling percentage:

Results in Table (19) indicated that seedbed preparation significantly influenced shelling percentage in one season out of two.

In the first season, the highest shelling percentage (81.23%) was produced by chisel plow (twice) followed by moldboard plow (once) + chisel plow (once) (80.69%) then moldboard plow (once) (80.33%). These three treatments did not differ significantly in their effect on shelling percentage. Whereas, the lowest shelling percentage was obtained by chisel plow (once) or no-tillage in the two growing seasons.

In the second season, the differences between the mean values of shelling percentage were not siginficant as affected by seedbed preparation.

These results might be attributed to the fact that shelling percentage is a genetical character that is less affected by environmental conditions.

Table (19): *Effect of seedbed preparation on ear characters, 100-grain weight (gm) and shelling percentage of maize in 1995 and 1996 seasons.*

Characters / Seedbed preparation	Ear length (cm)	Ear diameter (mm)	No of rows/ ear	No of grains / row	No of grains /ear	Ear weight (gm)	Grain weight / ear (gm)	100-grain weight (gm)	Shelling (%)
Season				**1995**					
No – tillage	16.34 c	44.34 c	13.43 c	34.45 d	462.44 d	174.52 c	137.75 c	30.65 b	78.84 c
Chisel plow (once)	16.29 c	44.36 c	13.48 c	35.35 c	476.52 c	176.79 c	140.59 c	30.77 b	79.36 c
Chisel plow (twice)	17.69 b	45.34 b	14.09 a	37.63 b	530.74 b	188.49 b	152.61 b	32.77 a	81.23 a
Moldboard plow (once)	17.62 b	45.86 b	13.94 b	37.19 b	518.56 b	189.74 b	152.89 b	32.81 a	80.33 b
Moldboard plow (once) + chisel plow (once)	18.82 a	46.89 a	14.11 a	39.41 a	555.15 a	200.92 a	162.14 a	33.00 a	80.69 ab
Season				**1996**					
No – tillage	16.57 c	44.88 b	13.56 b	35.69 c	483.90 c	176.54 d	139.48 d	30.67 c	79.04 a
Chisel plow (once)	16.78 c	44.64 b	13.66 b	36.00 c	492.31 c	177.13 d	140.10 d	30.54 c	79.22 a
Chisel plow (twice)	17.66 b	45.43 ab	14.08 a	37.82 b	532.57 b	186.98 c	149.98 c	32.48 b	79.91 a
Moldboard plow (once)	17.80 ab	46.36 a	14.24 a	38.21 ab	543.77 ab	192.44 b	154.26 b	32.79 ab	80.26 a
Moldboard plow (once) + chisel plow (once)	18.24 a	46.11 a	14.16 a	39.06 a	553.01 a	203.49 a	162.54 a	33.13 a	79.85 a

7-Ear and grain yield (kg)/ feddan:

Results presented in Table (20) showed that ear and grain yield per feddan were significantly affected by seedbed preparation in the two seasons.

The treatments of chisel plow (once), chisel plow (twice), moldboard plow (once) and moldboard plow (once)+ chisel plow (once) increased the ear yield per feddan by 3.50 , 20.23, 16.43 and 35.39%, respectively, over the control treatment (no-tillage) in the first season. The corresponding increases in ear yield in the second season were 5.33, 16.66, 23.88 and 33.16%, respectively.

With regard to grain yield per feddan, moldboard plow (once)+ chisel plow (once) gave the maximum grain yield / feddan (3246.83 and 3268.20 kg) in the first and second seasons, respectively. Whereas, no-tillage gave the minimum grain yield per feddan (2346.90 and 2432.37 kg) in the first and second season, respectively.

The increase in ear and grain yield / feddan may be due to the increase in the percentage of plants carried two ears, ear weight and 100-grain weight due to seedbed preparation treatments.

It could be concluded that moldboard plow (once) + chisel plow (once) surpassed the other treatments of seedbed preparation in ear and grain yield per feddan. The same trend was obtained by **Hakimi and Chakrabart (1976), Adeoya (1982), Camp et al. (1984), Disk and Van Doren (1985), Hargrove (1985), Hummel et al. (1985), Al-Darby (1986), Anderson (1986), Edwards et al. (1988), Wagger and Denton (1989), Cox et al. (1992), Hughes et al. (1992), Aflakpui et al. (1993),**

Gordon et al. (1993), Vyn and Raimbault (1993), Salim and El-Sergany (1995), Burgess et al. (1996) and Materechera and Mloza – Banda (1997).

8-Straw yield (kg) / feddan:

Results in Table (20) showed that seedbed preparation treatments had a significant effect on straw yield per feddan in 1995 and 1996 seasons.

In 1995 season, data revealed that the greatest straw yield / feddan (5385.72 kg) was produced with moldboard plow (once) + chisel plow (once), followed by chisel plow (twice) (4666.60 kg), moldboard plow (once) (4530.80 kg) and chisel plow (once) (4025.25kg) whereas, the lowest straw yield / feddan (3613.57kg) was obtained with no-tillage. Moldboard plow (once) + chisel plow (once) increased straw yield per feddan by 49.04% over no-tillage treatment.

In 1996 season, the treatments of moldboard plow (once)+ chisel plow (once), moldboard plow (once), chisel plow (twice) and chisel plow (once) increased straw yield / feddan by 37. 68, 25.16, 20,42 and 8.90%, respectively over the control treatment (no-tillage). The increase in straw yield / feddan as affected by seedbed preparation resulted from the increase in plant height, stem diameter, leaf area and dry weight of plant.

It could be concluded that moldboard plow (once) + chisel plow (once) gave the highest straw yield per feddan in both seasons.

Some investigators reported that straw yield of maize was significantly affected by seedbed preparation **(Hakimi and Chakrabarti,**

Table (20): *Effect of seedbed preparation on ear, grain and straw yield (kg)/ fed of maize in 1995 and 1996 seasons.*

Characters / Seedbed preparation	Ear yield kg/fed	%	Grain yield kg/fed	%	Straw yield kg/ fed	%
Season			**1995**			
No – tillage	2971.76 e	100	2346.90 e	100	3613.57 d	100
Chisel plow (once)	3075.83 d	103.50	2436.40 d	103.81	4025.25 c	111.39
Chisel plow (twice)	3572.90 b	120.23	2881.31 b	122.77	4666.80 b	129.15
Moldboard plow (once)	3460.02 c	116.43	2779.90 c	118.45	4530.80 b	112.38
Moldboard plow (once) + chisel plow (once)	4023.72 a	135.39	3246.83 a	138.34	5385.72 a	149.04
Season			**1996**			
No – tillage	3071.08 e	100	2432.37 e	100	3903.75 d	100
Chisel plow (once)	3234.91 d	105.33	2557.85 d	105.16	4251.35 c	108.90
Chisel plow (twice)	3567.04 c	116.66	2851.39 c	117.23	4701.03 b	120.42
Moldboard plow (once)	3804.61 b	123.88	3050.95 b	125.43	4885.77 b	125.16
Moldboard plow (once) + chisel plow (once)	4089.50 a	133.16	3268.20 a	135.36	5374.60 a	137.68

1976; El-Mallah, 1985; Al-Darby and Lowery, 1987; Hughes et al.1992; Nassar, 1992; Pinar et al. 1993).

B-Effect of biological fertilizers:

Data collected on the mean values of ear characters, 100 – grain weight, shelling percentage, ear yield, grain yield and straw yield per feddan as affected by biological fertilizers are shown in Tables (21 and 22).

1-Length and diameter of ear:

The results in Table (21) show that the differences between the mean values of length and diameter of ear were not significantly affected by using biological fertilizers in the two growing seasons.

The application of agrispon spraying and bacterial inoculation either alone or together caused a slight increase in ear length and diameter as compared with the control treatment in 1995 and 1996 seasons.

Foliar application of agrispon with bacterial inoculation gave the highest length and diameter of ear. All these increases were below the level of significance.

These results are in line with those obtained by **Abd El-Gawad et al. (1995), El-Gezawy et al. (1996) and Hassanein et al. (1997).**

2-Number of rows per ear:

Table (21) shows that biological fertilizer significantly increased number of rows per ear in the first season only.

In the first season, the highest value of number of rows/ear (13.92) was recorded with agrispon + bacterial inoculation followed by

application (13.81) and bacterial inoculation (13.79). whereas the lowest value (13.72) was obtained from the control treatment without siginficant difference among agrispon and bacterial inoculation either alone or together.

In the second season, number of rows / ear was not significantly differed due to biological fertilizer.

Similar results were reported by **Vlasak and Reynders (1981)** who found that inoculation with Azospirillum under low or intermediate levels of organic nitrogen significantly increased the yield components of maize. On the other hand, **Reiad et al. (1987), Abd El-Gawad et al. (1995), El-Gezaway (1996) and Hassanein et al. (1997)** showed that agrispon spraying as well as inoculation of grain maize with N_2 – fixing bacteria had no significant effects on number of rows / ear.

3-Number of grains per row and per ear :

It is clear from Table (21) that there was a significant effect for spraying agrispon and bacterial inoculation on the mean values of number of grains per row and per ear in one season out of two.

In the first season, foliar application of agrispon with bacterial inoculation gave the highest and significant number of grains per row and per ear as compared with the control treatment, whereas no significant difference was obtained between the three treatments of biological fertilizer.

In the second season, the increases in number of grains per row and per ear were too slight to reach the level of significance.

These results of the second season coincide with those obtained by **Abd El-Gawad et al. (1995), El-Gezaway (1996) and Hassanein et al. (1997).** They found that of spraying agrispon as well as bacterial inoculation did not significantly affect number of grains per row and per ear. On the other hand, **Vlasak and Reynders (1981)** noticed that inoculation with Azospirillum under low or intermediate levels of organic nitrogen significantly increased the yield components of maize and this confirm the results of the first season.

4-Ear weight and grain weight per ear:

Ear weight and grain weight per ear were not significantly affected by biological fertilizer treatments in 1995 and 1996 seasons. (Table 21).

In the first season, the application of agrispon either alone or combined with bacterial inoculation caused a slight increase in ear weight and grain weight per ear.

In the second season, bacterial inoculation with foliar application of agrispon gave the maximum weight of ear and grain weight per ear, followed by bacterial inoculation alone. All these increases were, however, below the level of significance.

On the other hand , the minimum ear weight and grain weight per ear (183.15 and 147.39 g) in the first season and (185.91 and 148.39 g) in the second season, respectively, were obtained from the control treatment.

It could be concluded that ear weight and grain weight per ear were not significantly affected by agrispon or bacterial inoculation. These results may be because ear length and ear diameter were not significantly affected by biological fertilizer treatments.

These results are in line with the findings of **Abd El-Gawad et al. (1995), El-Gezawy (1996) and Hassanein et al. (1997).**

5-100 – grain weight:

The results in Table (21) indicate that the mean values of 100-grain weight was not significantly affected by biological fertilizer treatments in both seasons.

Foliar application of agrispon with bacterial inoculation gave the maximum mean values of 100 – grain weight (32.13 and 32.28 g) in the first and second seasons, respectively. Whereas, the minimum 100-grain weight (31.70 and 31.67 g) was obtained from the control treatment in the first and second seasons, respectively.

It could be concluded that agrispon with bacterial inoculation gave the highest value of 100 –grain weight in both seasons without significant differences between the biological fertilizer treatments and the control treatment.

Similar conclussion was recorded by **El-Gezawy (1996) and Hassanein et al. (1997).**

6-Shelling percentage :

The differences between the mean values of shelling percentage were not significantly affected by the applied biological fertilizer treatments in the two growing seasons (Table 21). These results might be attributed to the fact that shelling percentage is a genetical character that is less affected by environmental conditions.

Table (21): *Effect of biological fertilizers on ear characters, 100 - grain weight (gm) and shelling percentage of maize in 1995 and 1996 seasons.*

Characters / Seedbed preparation	Ear length (cm)	Ear diameter (mm)	No of rows/ ear	No of grains / row	No of grains /ear	Ear weight (gm)	Grain weight / ear (gm)	100-grain weight (gm)	Shelling (%)
Season				**1995**					
Control (None)	17.19 a	45.25 a	13.72 b	36.28 b	500.65 b	183.15 a	147.39 a	31.70 a	79.88 a
Agrispon	17.41 a	45.39 a	13.81 ab	36.83 ab	508.96 ab	187.07 a	150.10 a	32.10 a	80.37 a
Bacterial inoculation	17.38 a	45.26 a	13.79 ab	36.92 ab	507.05 ab	186.96 a	149.19 a	32.07 a	80.13 a
Agrispon + bacterial inoculation	17.43 a	45.55 a	13.92 a	37.21 a	518.07 a	187.19 a	150.11 a	32.13 a	79.98 a
Season				**1996**					
Control (None)	17.36 a	45.33 a	13.98 a	37.01 a	517.67 a	185.91 a	148.39 a	31.67 a	79.40 a
Agrispon	17.44 a	45.46 a	13.85 a	37.44 a	518.16 a	186.93 a	148.45 a	31.90 a	79.68 a
Bacterial inoculation	17.39 a	45.44 a	13.99 a	37.38 a	522.92 a	187.58 a	149.48 a	31.83 a	79.73 a
Agrispon + bacterial inoculation	17.46 a	45.72 a	13.95 a	37.61 a	525.16 a	188.84 a	150.77 a	32.28 a	79.82 a

The same trend was obtained by **El-Gezawy (1996).** Who found that shelling percentage was not significantly affected by foliar application with agrispon.

7-Ear and grain yield (Kg) / feddan:

Results presented in Table (22) showed that biological fertilizer treatments had a significant effect on ear and grain yield per feddan in the first season only.

Foliar application of agrispon, bacterial inoculation and agrispon + bacterial inoculation increased the ear yield per feddan by 5.43, 3.29 and 7.76%, respectively over the control treatment in the first season. Also the corresponding increases in grain yield per feddan were 6.08, 3.44 and 7.44% , respectively.

On the other hand , all differences in ear and grain yield per feddan in the second season were below the level of significance.

It could be concluded that foliar application of agrispon alone or with bacterial inoculation gave the maximum yield of ear and grain per feddan. The increase in ear and grain yield per feddan may be due to the increase in number of rows / ear , number of grains per row and per ear and the percentage of plants carrying more than one ear as affected by biological fertilizer treatments in the first season only.

The same trend was obtained by **Burris et al. (1978), Rao et al. (1978), Nur et al. (1980), Vlasak and Reynders (1981), Hegazi et al. (1982), Moinb et al. (1982), Hegazi et al. (1983), Eid et al. (1984), Sarig et al. (1984), Wani and Konde (1986), Alagawadi and Gaur**

(1992), Balasubramania and Manickasundram (1993), El-Komy et al. (1993) and Hassanein et al. (1997). On the other hand, **Tilak et al. (1986), El-Borollosy et al. (1986), Abd El-Gawad et al. (1995), El-Gezawy (1996) and Terry et al. (1996)** found that agrispon and bacterial inoculation had no significant effect on yield of maize.

8-Straw yield (kg) / feddan:

Results presented in Table (22) showed that straw yield per feddan was significantly affected by biological fertilizers in one season out of two.

In the first season, the greatest straw yield per feddan (4634.17 kg) was produced with bacterial inoculation + foliar application of agrispon, whereas, the lowest one (4241.07 kg) was obtained from the control treatment. However no significant difference was obtained between foliar application of agrispon and bacterial inoculation on straw yield per feddan.

In the second season, biological fertilizers did not significantly affect straw yield per feddan.

It could be concluded that bacterial inoculation with application of agrispon gave the maximum straw yield per feddan followed by bacterial inoculation. The increase in straw yield / feddan as affected by biological fertilizer resulted from the increase in plant height, stem diameter, leaf area and dry weight of maize plant.

These results are in harmony with those obtained by **Nur et al. (1980), Kapulnik et al. (1981), O, Hara et al. (1981), Hegazi et al.**

Table (22): *Effect of biological fertilizers on maize yield of ear, grain and straw yield (kg) / fed. of maize in 1995 and 1996 seasons:*

Characters / Seedbed preparation	Ear yield kg/fed	%	Grain yield kg/fed.	%	Straw yield kg/ fed.	%
Season			**1995**			
Control (None)	3285.47 c	100	2631.65 c	100	4241.07 c	100
Agrispon	3463.93 ab	105.43	2771.77 ab	106.08	4437.35 b	104.63
Bacterial inoculation	3393.67 bc	103.29	2722.29 bc	103.44	4464.52 b	105.27
Agrispon + bacterial inoculation	3540.31 a	107.76	2827.36 a	107.44	4634.17 a	109.27
Season			**1996**			
Control (None)	3520.08 a	100	2807.29 a	100	4558.10 a	100
Agrispon	3540.70 a	100.59	2819.17 a	100.42	4595.05 a	100.81
Bacterial inoculation	3577.41 a	101.63	2846.76 a	101.41	4634.15 a	101.69
Agrispon + bacterial inoculation	3583.49 a	101.80	2855.38 a	101.71	4705.89 a	103.24

(1983), Eid et al. (1984), Lee et al. (1989), Alagawadi and Gaur (1992), El-Komy et al. (1993) and Hassanein et al. (1997). On the other hand, **El-borollosy et al. (1986)** reported that straw yield did not differ significantly due to bacterial inoculation.

C-Interaction effect:

The effect of the interaction between seedbed preparation and biological fertilizer treatments on all yield components of maize, ear and grain yield per feddan were not significant in the two growing seasons. Consequently, the data were excluded. Whereas, straw yield per feddan was siginificantly affected by the interaction between seedbed prparation and biological fertilizer in the first season only as shown in Table (23).

It is clear that bacterial inoculation after moldboard plow (once)+ chisel plow (once) gave the highest value of straw yield per feddan (5674.42 kg). Whereas no significant difference between the interaction of moldboard plow (once) + chisel plow (once) with bacterial inoculation alone and application of agrispon + bacterial inoculation on straw yield per feddan. On the other hand, the lowest one (3402.88 kg) was obtained from bacterial inoculation after no-tillage.

It could be concluded that bacterial inoculation alone or with foliar application of agrispon after moldboard plow (once) + chisel plow (once) gave the maximum straw yield of maize.

Table (23): *Interaction effects of the seedbed preparation and biological fertilizers on straw yield / fed (kg) of maize in 1995 season.*

Seedbed preparation / *Fertilizers*	*No- tillage*	*Chisel plow (once)*	*Chisel plow (twice)*	*Moldboard plow (once)*	*Moldboard plow (once) + chisel plow (once)*
Season			***1995***		
Control (None)	3451.49	3996.27	4326.51	4423.99	5007.09
Agrispon	3603.81	3966.78	4796.43	4520.96	5298.76
Bacterial inoculation	3402.88	3976.50	4796.43	4472.35	5674.42
Agrispon + bacterial inoculation	3996.12	4161.41	4744.78	4705.89	5562.63
L.S.D at 5 %			**285.31**		

IIV- Simple correlation

The correlation coefficient between grain yield and each of studied characters as well as between all the traits in the two growing seasons is shown in Tables (24 and 25).

Positive and significant correlation was detected between ear height and plant height (r=0.949** and 0.899**) in the f irst and second seasons, respectively or between number of leaves / plant and each of plant height (r=0.842** and 0.878**) and ear height (r=0.845** and 0.901**) in 1995 and 1996 seasons, respectively.

The results indicated clearly that stem diameter was highly and significantly correlated with each of plant height (r=0.920** and 0.868**), ear height (r=0.946** and 0.824**) and number of leaves / plant (r=0.917** and 0.852**) in the first and second seasons, respectively. Also, leaf area was significantly and positively correlated with each of plant height (r=0.904** and 0.880**), ear height (r = 0.905** and 0.774**), number of leaves / plant (r=0.670** and 0.709**) and stem diameter (r=0.859** and 0.707**) in 1995 and 1996 seasons, respectively.

The association between time of tasseling and each of plant height, ear height, number of leaves/ plant, stem diamter and leaf area was negative and highly significant in both seasons. The respective correlations were – 0.784**, -0.729**, -0.767**, -0.759** and –0.680**, respectively in the first season (Table 21) as well as –0.760**, -0.720**, -0.750**, -0.670** and –0.731**, respectively in the second season (Table 25) Also, Time of silking and each of plant height, ear height, numbr of

leaves / plant , stem diameter and leaf area was the same trend with time of tasseling. Whereas, time of silking was positively and high significantly correlated with time of tasseling (r=0.906** and 0.637** in the first and second seasons, respectively).

Also, positive and significant correlations were detected between total chlorophyll and each of plant height (r= 0.436*) ear height (r= 0.552*), stem diameter (r= 0.459*) and leaf area (r= 0.466*) in the first season (Table 24). Whereas negative correlation was obtained between chlorophyll content and each of time of tasseling and time of silking in both seasons. Meanwhile, in the second season, total chlorophyll was positive and significantly correlated with each of plant height (r = 0.536*) and leaf area (r=0.605**) (Table 25).

The association between grain weight /ear and each of plant height, ear height number of leaves plant, stem diameter, leaf area, total chlorophyll, ear length, ear diameter, number of grains/ ear and ear weight was highly significant and positive in both seasons. The respective correlations were 0.906**, 0.917**, 0.878**, 0.935**, 0.801** , 0.507*, 0.943**, 0.928** 0.959** and 0.988** in the first season (Table 24), respectively as well as in the second season, the respective correlation were 0.921**, 0.844**, 0.798** , 0.787**, 0.866**, 0.644**, 0.800**, 0.871**, 0.936** and 0.988**, respectively (Table 25). On the other hand, negative and highly significant correlation was obtained between grain weight / ear and each of time of tasseling (r= -0.718**) and time of silking (r= -0.707**) in the first season (Table 24). Also, the same trend in association

between grain weight / ear and time of tasseling (r= -0.598**) was recorded in the second season (Table 25).

The results indicated clearly that 100 – grain weight was positive and significantly correlated with each of plant height, ear height, number of leaves/plant, stem diameter, leaf area, total chlorophyll, ear length , ear diameter, number of grains / ear, ear weight and grain weight / ear in the two growing seasons. Whereas, negative and significant correlation coefficients were detected between 100 – grain weight and each of time of tasseling (r =-0.511**) and time of silking (r = - 0.460*) in the first season only (Table 24). Similar results were found by **Salwau (1993)** who indicated that significant positive phenotypic correlation was found between 100–grain weight and each of number of grains / rwo , ear weight, grain weight / ear , ear length, ear dimaeter and number of rows / ear.

Significant positive correlation values were found between grain yield/feddan and each of plant height , ear height, number of leaves/ plant, leaf area, total chlorophyll , ear length, ear diameter, number of grains/ear, ear weight, grain weight/ ear, 100 – grain weight, shelling percentage, ear yield and straw yield / feddan in the two growing seasons (Tables 24 and 25). The present results are in agreement with those obtained by **Nawar et al. (1984), El-Hosary et al. (1989), Sary et al. (1990), Hefeni et al. (1993) and Salwau (1993)**, who found that yield of maize was positively and significantly correlated with some yield components.

Highly significant negative phenotypic correlation coefficient was found between grain yield / feddan and number of days to 50 % tasseling (r=0.790 and –0.610**) in the first and second seasons, respectively. Also, grain yield / feddan was negative and significantly correlated with number of days to 50% silking (r= -0.738**) in the first season only. The same trend was also realized by **Tya Gl et al. (1988)** who indicated that number of days to 50% silking was negatively correlated with grain yield.

It could be concluded that the grain yield was positively associated with yield components of maize as affected by the interaction between seedbed preparation and biological fertilizers under study.

Table (24): *Simple phenotypic correlation between grain yield and some growth and yield components of maize as affected by the interaction between seedbed preparation and biological fertilizers in 1995 season.*

Characters	Plant height	Ear height	No of leaves /plant	Stem diameter	Leaf area	Time of tasseling	Time of silking	Total chl	Caroten	Ear length	Ear diameter	No of grains / ear	Ear weight	Grain weight	100-grain weight	Shelling %	Ear yield /fed	Straw yield/fed	Grain yield / fed
Plant height	1.000																		
Ear height	0.949**	1.000																	
No.of leaves/plant	0.842**	0.845**	1.000																
Stem diameter	0.920**	0.946**	0.917**	1.000															
Leaf area	0.904**	0.905**	0.670**	0.859**	1.000														
Time of tasseling	-0.784**	-0.729**	-0.767**	-0.759**	-0.680**	1.000													
Time of silking	-0.799**	-0.752**	-0.731**	-0.745**	-0.679**	0.906**	1.000												
Total chlorophyll	0.456*	0.552*	0.328	0.459*	0.466*	-0.274	-0.309	1.000											
Carotenoids	0.286	0.237	0.272	0.277	0.203	-0.166	-0.180	0.479*	1.000										
Ear length	0.946**	0.914**	0.899**	0.936**	0.809**	-0.733**	-0.732**	0.367	0.234	1.000									
Ear diameter	0.870**	0.881**	0.886**	0.876**	0.771**	-0.714**	-0.662**	0.529*	0.263	0.892**	1.000								
No. of grains/ear	0.940**	0.950**	0.834**	0.936**	0.874**	-0.686**	-0.670**	0.563*	0.319	0.945**	0.884**	1.000							
Ear weight	0.896**	0.906**	0.890**	0.932**	0.795**	-0.739**	-0.705**	0.523*	0.247	0.941**	0.936**	0.950**	1.000						
Grain weight /ear	0.906**	0.917**	0.878**	0.935**	0.801**	-0.718**	-0.707**	0.507*	0.246	0.943**	0.928**	0.959**	0.988**	1.000					
100-grain weight	0.819**	0.840**	0.720**	0.841**	0.724**	-0.511*	-0.480*	0.599**	0.228	0.870**	0.829**	0.924**	0.899**	0.915**	1.000				
Shelling %	0.687**	0.687**	0.549*	0.686**	0.625**	-0.426	-0.480*	0.254	0.240	0.722**	0.593**	0.755**	0.680**	0.771**	0.741**	1.000			
Ear yield / fed	0.814**	0.790**	0.738**	0.818**	0.709**	-0.621**	-0.574**	0.599**	0.491*	0.839**	0.726**	0.891**	0.820**	0.808**	0.831**	0.617**	1.000		
Straw yield /fed	0.926**	0.947**	0.858**	0.950**	0.859**	-0.714**	-0.698**	0.552*	0.354	0.916**	0.852**	0.953**	0.909**	0.903**	0.868**	0.637**	0.892**	1.000	
Grain yield / fed	0.919**	0.910**	0.889**	0.932**	0.824**	-0.790**	-0.738**	0.504*	0.382	0.926**	0.935**	0.944**	0.903**	0.957**	0.849**	0.676**	0.803**	0.916**	1.000

Table (25): Simple phenotypic correlation between grain yield and some growth and yield components of maize as affected by the interaction between seedbed preparation and biological fertilizers in 1996 season:

Characters	Plant height	Ear height	No of leaves /plant	Stem diameter	Leaf area	Time of tsseling	Time of silking	Total chl.	Caroten	Ear length	Ear diameter	No of grains / ear	Ear weight	Grain weight	100-grain weight	Shelling %	Ear yield /fed	Straw yield/fed	Grain yield / fed
Plant height	1.000																		
Ear height	0.899**	1.000																	
No.of leaves/plant	0.878**	0.901**	1.000																
Stem diameter	0.868**	0.824**	0.852**	1.000															
Leaf area	0.880**	0.774**	0.709**	0.707**	1.000														
Time of tasseling	-0.760**	-0.720**	0-750**	-0.670**	-0.731**	1.000													
Time of silking	-0.485**	-0.431	-0.480*	-0.499*	-0.368	0.637**	1.000												
Total chlorophyll	0.536*	0.411	0.398	0.384	0.605**	-0.368	-0.302	1.000											
Carotenoids	0.257	0.287	0.327	0.324	0.222	-0.290	-0.254	0.494*	1.000										
Ear length	0.757**	0.760**	0.715**	0.742**	0.637**	-0.526	-0.495*	0.495*	0.053	1.000									
Ear diameter	0.759**	0.768**	0.758**	0.670**	-0.644**	-0.403	-0.327	0.572**	0.166	0.743**	1.000								
No of grains/ear	0.834**	0.818**	0.794**	0.790**	0.826**	-0.526*	-0.318	0.680**	0.263	0.810**	0.876**	1.000							
Ear weight/ear	0.930**	0.860**	0.819**	0.788**	0.869**	0.641**	-0.379	0.667**	0.261	0.770**	0.850**	0.914**	1.000						
Grain weight	0.921**	0.844**	0.798**	0.787**	0.866**	-0.598**	-0.368	0.644**	0.179	0.800**	0.871**	0.936**	0.988**	1.000					
100-grain weight	0.728**	0.667**	0.656**	0.661**	0.676**	-0.319	-0.217	0.630**	0.145	0.741**	0.906**	0.918**	0.864**	0.902**	1.000				
Shelling %	0.347**	0.286	0.272**	0.357	0.345**	-0.074	-0.100	0.172	-0.355	0.566**	0.488*	0.538*	0.385	0.513*	0.612**	1.000			
Ear yield / fed	0.882**	0.852**	0.800**	0.790**	0.859**	-0.628**	-0.346	0.709**	0.299	0.752**	0.860**	0.940**	0.972**	0.966**	0.869**	0.397	1.000		
Straw yield /fed	0.907**	0.864**	0.854**	0.882**	0.819**	-0.707**	-0.505*	0.616**	0.225	0.859**	0.830**	0.923**	0.931**	0.936**	0.827**	0.464*	0.935**	1.000	
Grain yield / fed	0.889**	0.849**	0.799**	0.796**	0.856**	-0.610**	-0.360	0.695**	0.264	0.773**	0.872**	0.953**	0.972**	0.976**	0.892**	0.467*	0.997**	0.941**	1.000

SUMMARY

Two field experiments were carried out at the Agricultural Research and Experiment center of the Faculty of Agriculture at Moshtohor, Kalubia Governorate, Zagazig University during 1995 and 1996 seasons to study the effect of seedbed preparation and biological fertilizer treatments on chemical and biological properties of soil, growth characters, yield and its components of maize cultivar single cross 128.

The soil was clay loam with pH 7.7. Each experiment included the combination of five seedbed preparation treatments and four treatments of biological fertilizer. The design of the experiment was split plot design with four replications. The treatments were as follows:

A-Seedbed preparation:

1-Zero tillage or no-tillage.

2-Chisel plow (once) alone.

3-Chisel plow (twice).

4-Moldboard plow (once) alone.

5-Moldboard plow (once) + chisel plow (once).

B-Biological fertilizer treatments:

1-Control: without application of agrispon or cerialin.

2-Foliar application of agrispon. Spraying was carried out once, 45 days from planting.