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RESPONSE OF WHEAT TO NITROGEN UNDER DIFFERENT TILLAGE SYSTEMS.

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ABSTRACT

Two filed experiments were conducted during 1998/99 and 1999/2000 seasons at the Agricultural Research and Experiment Center of the Faculty of Agricultural Moshtohor to study the effect of different tillage systems including chisel plowing, moldboard plowing at two depths (18-20 and 28-30cm) as well as no-till and N fertilization levels (zero, 30, 60, 90, 120 kg/fed.) on yield and its components of wheat, associated weeds, some soil properties as well as economic evaluation of the studied treatments. Results revealed that moldboard plowing at 28-30cm showed the lowest value of bulk density whereas, soil porosity percentage increased at both depths for moldboarding. Also, at the same depth, weed infestation was reduced. Increasing nitrogen level significantly reduced weed infestation at 45 days from planting and at harvest.The highest values of grain and straw yields of wheat and its attributes (number of tillers/m², 1000-grain weight, and spike weight)were recorded when using moldboard plowing at both depths.Increaing nitrogen rates significantly increased grain and straw yield and yield components of wheat. The maximum grain yield was recorded by applying nitrogen rate of 120kg/fed. The interaction including moldboard plowing at 28-30cm with applying 120kgN/fed.was the best in depressing weed.The maximum net return was recorded by moldboarding (28-30cm) combined with applying 120kgN/fed. in both seasons.

INTRODUCTION

Seedbed preparation and nitrogen fertilizer are among the most important factors which have profound effects on the growth and production of wheat, depressing associated weed competition and improving soil properties. With respect to crop growth and production, it is well known that the crop response curves may be very different for different tillage systems as well as for soil with different texture and nitrogen and organic matter content. Adequate selection of tillage systems can increase crop production by increasing water availability, eliminating weed competition, and allowing a better development of root systems.

In Egypt, tillage systems have evolved during last years from minimum tillage (chisel plow) to an inversion system (moldboard plow) or to a vertical

system (sub soiler) more suited to loosen lower layers to increase infiltration and to reduce weed infestation. Reviews of the effects of inversion system showed that moldboard plowing, can increase grain yield of wheat (Rizvi *et al.*, 1990; Gomaa, 1995 and Shafshak *et al.*, 2003) by improving soil properties (Gomaa, 1995; Gomaa and El-Naggar, 1995 a and b; Khadr *et al.*, 1998 and Shafshak *et al.*, 2003) and controlling weeds (Buhler and Thomas, 1991; Schreiber, 1992; Gomaa, 1995; Botto *et al.*, 1998 and Shafshak *et al.*, 2003). Numerous studies have also been conducted on the effects of chisel plowing on soil physical characteristic (Aggarwel *et al.*, 1997), eliminating weed density (Catizone *et al.*, 1990 and Tadesse *et al.*, 1996) and on growth and grain yield of wheat (Gill and Aulakh, 1990; Vining and Schroeder, 1992 and Mc Conkey *et al*, 1997).

Nitrogen fertilizer is also a major factor for wheat since it had intense effects on plant growth and grain yield (Dardiry, 1999; Mehasen, 1999; Munir *et al.*, 2000; Abou El-Ela, Sabah, 2001 and Bori, 2003).

This work has been conducted to evaluate the response of wheat to five levels of nitrogen fertilization under four tillage systems. The parameters measured include associated weeds, soil properties, grain yield and its components as well as economic evaluation of studied treatments.

MATERIALS AND METHODS

During the 1998/99 and 1999/2000 seasons, two field experiments were conducted at the Agriculture Research Center, Faculty of Agriculture at Moshtohor, Zagazig University to study the effect of different tillage systems and N levels fertilization on the wheat cv. Giza 168 productivity and associated weeds as well as soil properties. The soil was clay loam with pH 7.8 and 1.8% organic matter content. In both growin seasons wheat was preceded by maize. Each experiment included 20 treatments; they were a combination of four tillage systems and five N levels.

The tillage systems were:

1- No-tillage.
2- Chisel plowing alone. Chisel plow is a 7-blade mounted type plow. Every two blades of the same row were 50cm apart. It stirs the soil for a depth of 15cm.
3- Moldboard plowing at a depth of 18-20cm. Moldboard plowing was done by a single share mounted type plow.
4- Moldboard plowing at a depth of 28-30cm.

Disk plowing followed by compacting were done after each of the above tillage treatments except for the control (no-tillage).

The N levels were: zero, 30, 60, 90 and 120 kg/fed. in the form of urea (46.5% N) applied in split amounts before the first and second irrigations.

The two experiments were planted on Dec.11 in the first season and Nov.30 in the second season. Other normal cultural practices of growing wheat were followed.

The design of the experiment was a strip-plot design (Gomez and Gomez, 1984) with four replications. The strip-plots were assigned for the four tillage treatments and the sub-plots for the five N levels. The treatments were distributed at random in the respective plots. The sub-plot area was 10.5 m^2.

Characters studied:

A. Soil properties:

Soil samples, for soil measurements were collected from 0-10, 10-20 and 20-30 cm depths in each subplot. Soil samples were taken 20 days from planting as well as at harvest. From the soil samples the following data were recorded:

1- Bulk density: It is determined by dividing the soil oven dry weight in grams by soil volume in cubic centimeter (ASTM, 1980).
2- Soil porosity: Soil porosity space percentage was estimated according to ASTM, (1980) by the following formula:

$$\text{Soil porosity} = \frac{Ps - Pb}{Ps} \times 100$$

where: Ps = Real density (g/cm^3) was estimated according to Donahue (1958).
Pb = Bulk density (g/cm^3).

B. Weed survey:

Weeds were hand pulled and collected from one square meter in each plot twice, at 45 days from planting and at harvest. Fresh and dry weight of weeds (g) were recorded per one square meter.

C. Wheat characters:

Number of tillers/m^2, number of spikes/m^2, plant height (cm), spike length (cm), spike weight (g), spike grain weight (g), 1000- grain weight (g) and grain (ardab) and straw (ton) yield /fed. were recorded. Plant height was determined from 10- plant randomly selected samples at harvest, spike characters were recorded as an average of 10- randomly spikes, while grain and straw yields were estimated on the whole plot basis.

D. Economic evaluation:

In the present study, the economic evaluation included three estimates as follows:

1- Average input variable as well as total costs of wheat production as affected by different tillage systems and N levels fertilization.
2- Net farm income of wheat production as affected by different treatments studied. Net farm income is the value of grain and straw yields according to the actual price.

3- Net farm return of wheat production as affected by the different studied treatments. It is the difference between grain yield value according to the actual price and the total costs including land rent.

All estimation are based on the official and actual market prices determined by the Ministry of Agriculture and the Agricultural Credit and Development Bank. Costs of seedbed preparation treatments were estimated according to prices given by Agricultural Mechanization Service, for the locality (Toukh District).

RESULTS AND DISCUTION

A. Soil characters:

A -1: Bulk density:

The results in Table (1) show that tillage systems significantly affected soil bulk density at 20 days from planting only in the second season and at harvest in the two seasons. The lowest bulk density was recorded by using the most intensive soil tillage including moldboard plowing (28-30cm). Also, soil depth significantly affected bulk density at 20 days and at harvest in both seasons. The lowest value was recorded at a soil depth of (0- 10cm).In the two seasons, the no-till, at all three depths was significantly higher than the other tillage systems (Table 1). The present results agree with those reported by Gomaa (1995) and Khadr *et al.* (1998).

A-2: Soil porosity:

The results in Table (1) indicate that tillage systems had significant effect on porosity % of the soil at 20 days as well as at harvest in both seasons. In the first season, moldboard plowing (28-30cm) recorded the highest porosity % but without any significant difference when compared with moldboard plowing (18-20cm) in the second season. Porosity % significantly and consistently reduced with the increase in soil depth at 20 days and at harvest in both seasons. At the three different soil depths, soil porosity % significantly increased with moldboard plowing (28-30cm) followed by moldboard plowing (18-20cm) at a soil dipth of (0-10cm) at 20 days and at harvest in the first season. At all depths, the no-till treatment consistently resulted in significantly lower soil porosity than did all of the other tillage systems. Similar results were also reported by Gomaa (1995) and Shafshak *et al.* (2003).

In conclusion, tillage practices may reduce soil compactness and also improve mechanical disturbance of soil. On the other hand, no-tillage may cause consolidation of soil that lead to soil porosity reduction.

B. Weed growth:

The weed commonly grown with wheat during the two seasons of experiment were: Wild mustared (*Brassica nigra* [L.] Koch.), Wild beet (*Beta vulgaris* L.), Wild chicory (*Cichorium pumilum* Jacq.), Sour weed (*Rumex dentatus* L.), Bur clover weed (*Medicago hispida* Gaerten.), Bishops weed (*Ammi majus* L.), Shepherds purse (*Capsella bursa- pastoris* [L.]Medik), Sow thistle (*Sonchus oleraceus* L.) and Pimpernel (*Anagallis arvensis* L.).

Table (1):Effect of tillage systems on physical properties of soil.

Characters	DEPH (CM)	Treatments									
		At 20 days					At harvest				
		NT	CP	MP1	MP2	Mean	NT	CP	MP1	MP2	Mean
		1998/1999 season									
Bulk density (g/cm³)	0-10	1.08	1.06	1.05	1.00	1.05	1.20	1.16	1.15	1.09	1.15
	10-20	1.18	1.09	1.09	1.07	1.11	1.28	1.21	1.18	1.17	1.21
	20-30	1.21	1.21	1.18	1.13	1.18	1.34	1.29	1.29	1.19	1.28
	Mean	1.16	1.12	1.11	1.07		1.27	1.22	1.20	1.15	
LSD at 5%		Tillage (T) NS Soil depth (D) 0.02 (TxD) NS					(T) 0.03 (D) 0.02 (TxD) NS				
Porosity (%)	0-10	49.4	52.0	53.4	54.9	52.4	43.7	48.6	50.2	52.1	48.6
	10-20	44.5	47.1	50.9	52.8	48.8	38.8	42.8	46.4	50.9	44.7
	20-30	36.5	42.4	48.1	52.5	44.9	30.7	39.6	44.8	45.5	40.1
	Mean	43.5	47.2	50.8	53.4		37.7	43.7	47.1	49.5	
LSD at 5%		(T) 1.49 (D) 0.37 (TxD) 2.58					(T) 1.38 (D) 0.88 (TxD) 2.39				
		1999/2000 season									
Bulk density (g/cm³)	0-10	1.10	1.09	1.07	1.05	1.08	1.23	1.16	1.15	1.12	1.16
	10-20	1.17	1.16	1.11	1.07	1.13	1.29	1.25	1.21	1.12	1.22
	20-30	1.21	1.19	1.18	1.07	1.16	1.33	1.27	1.25	1.23	1.27
	Mean	1.16	1.15	1.12	1.06		1.28	1.23	1.20	1.15	
LSD at 5%		Tillage (T) 0.03 Soil depth (D.) 0.08 (TxD) N S					(T) 0.03 (D) 0.01 (TxD) NS				
Porosity (%)	0-10	50.7	53.0	54.2	57.1	53.7	45.2	48.9	54.5	53.4	50.5
	10-20	44.0	48.6	51.8	52.9	49.3	39.6	45.0	48.0	48.6	45.3
	20-30	36.6	41.6	47.9	50.5	44.0	30.0	37.8	43.1	47.2	39.5
	Mean	43.7	47.7	51.3	53.3		38.2	43.9	48.5	49.7	
LSD at 5%		(T) 2.65 (D) 1.32 (TxD) N S					(T) 2.83 (D) 2.76 (TxD) NS				

NT=No-till CP= Chisel plow MP1= Moldboard plow (18-20)
MP2= Moldboard plow (28-30)

B-1: Effect of tillage:

Among all applied tillage treatments there were significant differences for both fresh and dry weight of weeds/m² in both surveys (at 45days from planting and at harvest) in both seasons (Table 2). It is clear that moldboard plowing (28-30cm) was the best treatment in producing substantially decrease in fresh and dry weight of weeds/m² estimated at 45 days from planting in both seasons and at harvest in the first season. While, using moldboard plowing to 18-20cm or 28-30cm were similar in their effect in reducing fresh and dry weight of weeds/m² at harvest in the second season, (Table 2). This may be due to that

moldboard plowing turns upside down the soil surface layer which contains most weed seeds to deep layer so as it can not germinate, consequently weed infestation is reduced.

Results reported here are in agreement with those reported previously by Gomaa (1995), Botto *et al.* (1998) and Shafshak *et al.* (2003).

B-2: Effect of nitrogen:

The results showed that the fresh and dry weights of wheat weeds/m² were significantly affected by nitrogen levels in both surveys in both seasons (Table 2). Increasing nitrogen level significantly reduced weed infestation in both surveys. The lowest weed presence was obtained at the highest N level (120kg/fed.). This may be due, inpart, to the stimulating effect of nitrogen fertilizer levels on wheat plant growth especially number of tillers where it leads to the increase of inter specific competition between wheat and weeds under high level of nitrogen. This competition was in favor of wheat plants.

Table (2):Wheat weeds fresh and dry weight (g/m²)for different treatments.

Treatments	1998/1999 SEASON				1999/2000 SEASON			
	Fresh weight		Dry weight		Fresh weight		Dry weight	
	At 45 days	At Harvest	At 45 days	At harvest	At 45 days	At harvest	At 45 days	At harvest
Tillage systems								
No-till	191.24	374.00	43.78	192.98	77.64	115.24	34.16	58.76
Chisel plow	168.72	295.33	38.62	152.40	64.42	103.22	28.34	52.64
Moldboard plow (18-20 cm)	119.98	260.86	29.60	134.61	53.44	85.19	23.51	43.45
Moldboard plow (28-30cm)	78.94	224.40	18.06	115.28	44.58	82.00	18.74	41.82
LSD at 5%	15.41	14.09	2.59	7.30	6.12	10.08	1.64	5.12
Nitrogen rate (kg/ fed.)								
0	187.07	387.5	42.82	199.95	85.42	145.27	37.57	74.10
30	145.02	353.33	35.88	182.33	72.00	117.25	30.58	59.79
60	134.18	280.25	30.70	144.60	55.87	88.53	24.58	45.15
90	129.56	220.91	29.66	114.00	45.04	73.84	19.82	37.66
120	102.76	200.00	23.52	103.19	41.76	57.17	18.39	29.14
LSD at 5%	14.81	14.45	1.33	7.46	5.28	10.09	2.69	5.13

C. Yield and its components:

C-1:Effect of tillage:

Data in Table (3) reveal that tillage systems significantly affected all studied characters of wheat except plant height, 1000-grain weight and spike weight in the second season; grain weight per spike in the first season and spike length in both seasons. Moldboard plowing (28-30cm) was the highest treatment. While, using moldboard plowing to 28-30 or 18-20 cm were similar in their effect on plant height, 1000-grain weight, spike weight and straw yield in the first season, number of tillers/m² in the second season and grain yield in both seasons.

The lowest treatment was the check (no-till).Results indicated that grain yield/fed. increased (above that in no-till treatment) nearly by 22, 17 and 4 % in the first season compared to 12, 7 and 3% in the second season by using tillage systems as moldboarding (28-30cm), moldboarding (18-20cm)and chisel plowing, respectively.

It could be concluded that moldboard plowing may lead to improvement of soil physical properties and structure along the sowing layer depth which attains a good germination, a deeper penetration of the root system through the soil and increases microbiological activity in the rhizosphere layer. All these factors affect well yield quantity by affecting its components. These results are in agreement with those obtained by Gomaa (1995) and Safshak *et al* (2003).

C-2:Effect of nitrogen:

It is clear from Table (3) that fertilizer nitrogen rate had a highly significant effect on all studied traits of wheat in both seasons. This trend was very clear when rate of nitrogen increased up to 120kg N/fed. Whereas no significant differences between the highest two levels (90 and 120kg N/fed.) in plant height and straw yield/fed. in the first season, spike length and 1000-grain weight in the second season and spike grain weight in both seasons. Weight of 1000 grains in the first season as well as plant height, number of tillers/m^2, number of spikes/m^2 and spike weight in the second season showed no significant differences when nitrogen rates increased from 60 to 120kg N/fed.

Wheat grain yield/fed. was increased by 62, 78, 95 and115% over the control (zeroN/fed.) in the first season, corresponding to 75, 84, 98 and 111% in the second season, respectively for 30, 60, 90 and120 (kgN/fed.) applications.

These results were expected since N fertilization leads to increase nitrogen percentage in plant organs and retard leaf senescence, consequently the wheat plant efficiency in producing the dry matter increase because the photosynthesis rate increased. Therefore, number of tillers especially fertile tillers as well as fertile spikelets (grains) per spike increased by increasing rate of nitrogen up to 120kgN/fed. These results are in agreement with those observed previously by Dardiry (1999), Abou El-Ela, Sabah (2001) and Bori (2003).

D: Interaction effects:

D-1: Weed growth:

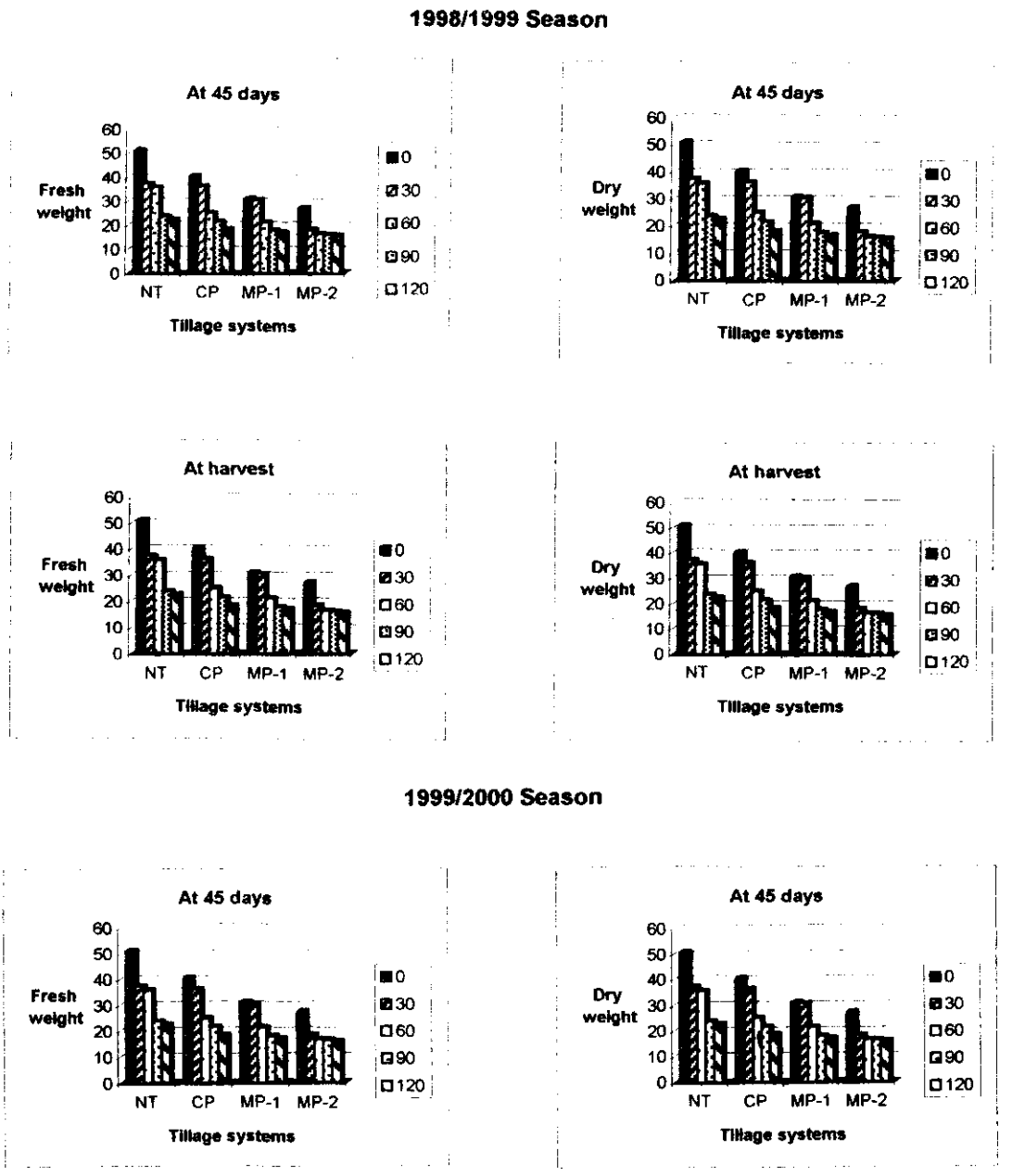
It is indicated in Table (4) and Fig. (1) that the interaction effects of the two experimental factors had a significant effect on fresh and dry weights of wheat weeds. It was clear from Table (4) and Fig. (1) that the interaction including moldboarding (28-30cm) with applying 120kgN/fed. contained lower fresh and dry weights of wheat weeds at 45 days from planting in both seasons and at harvest only in the first season. This may be due to the height efficiency of moldboard plowing in weed control and also to the stimulating effect of N fertilizer on wheat plant tillering. From here, wheat plants compete well with weeds causing a marked reduction in weed density.

The general conclusion is that moldboard plowing plays a positive role in soil physical properties (Table 1) as well as weed competition, (Table 2). In addition N fertilizer rate affects greatly wheat yield. Grain yield increased with increase in the fertilizer N rate (Table 3).

Table (3): Yield and yield component of wheat for different treatments

Treatments	Plant height (cm)	No.of Tillers/ m²	No.of Spikes/ m²	Spike Length (cm)	Weight Of 1000 grains (g)	Spike Weight (g)	Grain Weight/ spike (g)	Grain Yield (ard./ fed)	Straw Yield (t/fed)
1998/1999 season									
Tillage systems									
No- till	108.88	303.46	290.93	13.56	35.57	2.35	1.67	13.83	3.16
Chisel plow	111.98	315.46	304.13	13.88	40.19	2.42	1.67	14.43	3.51
Moldboard plow (18-20cm)	114.32	327.33	313.73	13.96	40.91	2.58	1.71	16.21	3.67
Moldboard plow (28-30cm)	116.82	339.66	328.33	14.40	42.36	2.69	1.79	16.86	4.08
LSD at 5%	2.72	11.69	6.18	NS	2.44	0.20	NS	1.11	0.43
Nitrogen rate (kg/fed)									
0	106.98	292.33	274.58	12.11	34.51	1.95	1.30	9.02	2.53
30	109.97	313.16	301.91	13.50	38.47	2.39	1.63	14.60	3.55
60	113.14	321.75	314.50	14.03	40.04	2.59	1.81	16.06	3.77
90	116.62	332.83	318.75	14.65	42.57	2.74	1.88	17.59	3.99
120	118.28	347.33	336.66	15.44	43.20	2.89	1.92	19.39	4.19
LSD at 5%	3.40	13.98	6.75	0.39	3.19	0.14	0.08	1.38	0.38
1999/2000 season									
Tillage systems									
No- till	107.92	318.66	302.40	13.86	36.53	2.46	1.56	15.10	3.09
Chisel plow	110.0	328.40	311.13	14.52	37.26	2.50	1.64	15.49	3.23
Moldboard plow (18-20cm)	109.88	343.06	332.66	14.57	38.20	2.63	1.75	16.21	3.54
Moldboard plow (28-30cm)	111.35	357.46	350.13	15.12	38.53	2.73	1.98	16.92	3.95
LSD at 5%	NS	22.49	11.86	NS	NS	NS	0.16	0.71	0.35
Nitrogen rate (kg/fed)									
0	104.16	315.33	299.25	11.76	33.16	1.92	1.21	9.20	2.22
30	108.58	319.5	309.58	13.7	36.25	2.58	1.65	16.09	3.25
60	110.38	342.66	325.75	14.30	37.41	2.71	1.77	16.90	3.52
90	111.21	346.33	340.58	15.91	40.16	2.78	1.97	18.02	3.89
120	114.60	360.66	345.25	16.91	41.16	2.91	2.05	19.45	4.39
LSD at 5%	5.57	32.38	21.93	1.39	2.83	0.39	0.24	0.79	0.44

This favourable effect of fertilizer N was more marked on wheat yield when interacted with moldboard plowing and was reflected in lower weed infestation (Table 4).



NT=No-till CP=Chisel plow MP-1=Moldboard plow (18-20cm)

MP-2=Moldboard plow(28-30cm)

Fig. (1): Effect of tillage systems and N fertilizer rate on fresh and dry weight of wheat weeds (g/m2).

Table (4): Summary of significant interaction effects between the two experimental factors (Tillage systems and nitrogen fertilizer level), on fresh and dry weight of weeds/m², showing the lowest values recorded and involved combination.

Character	Lowest value	Combination of treatments
1998/1999 season		
Fresh weight of weeds at 45 days from planting.	60.67 g	Moldboarding (28-30cm) XN120
Dry weight of weeds at 45 days from planting.	13.90 g	" "
Fresh weight of weeds at harvest	110.00 g	" "
Dry weight of weeds at harvest	56.76 g	" "
1999/2000 season		
Fresh weight of weeds at 45days from planting.	35.70 g	" "
Dry weight of weeds at 45 days from planting.	15.70 g	" "

E: Economic evaluation:

E-1: Effect of tillage systems and N fertilizer on the total costs of wheat production:

Total costs include values of production tools and requirements such as land preparation, fertilizer, seeds, man power and other expenses or miscellaneous costs as well as land rent (average of 1998/1999 and 1999/2000 seasons)are shown in Table (5) and the costs of the different soil tillage and N fertilizer treatments included in the study are given in Table (6).

Table (5): Costs of the different seedbed preparation practices (average of 1998/1999 and 1999/2000 seasons).

Treatment	Costs Per Fed. In L.e.
Chisel plow	18.00
Moldboard plow to 18-20 or 28-30cm.	42.00
Disc harrowing	13.20
Compacting	12.00
30kgN/fed. as urea (46, 5%)	52.20
60kgN/fed.	104.30
90kgN/fed.	156.60
120kgN/fed.	208.70
Seeds	79.80
Man power	270.00
Other Expenses	58.40
Land rent	646.60

The price of one kg nitrogen in the form of urea (46.5%N) was 1.74LE. The price of one kg Giza 168 grain was 1.33 LE. Man power was calculated on the basis of 45 workers per fed. for all practices and a wage of 6.5LE.for the worker.

Table (6): Costs of different soil tillage and N fertilizer treatments included in the study (in L.E./fed.). (average of 1998/1999 and 1999/2000 seasons).

Treatment	N levels (kg/fed.)				
	0	30	60	90	120
Zero tillage	------	52.20	104.30	156.60	208.70
Chisel plow	43.20	95.40	147.50	199.80	251.90
Moldboard plow (18-20cm)	67.00	119.20	171.30	223.60	275.70
Moldboard plow (28-30cm)	67.00	119.20	171.30	223.60	275.70

The soil tillage treatment costs included also the cost for disk harrowing and compacting. It is evident from Table (6) that the highest values of costs were those of the treatment including moldboarding to 18-20cm or 28-30cm combined with applying 120N, being 275.70L.E. per fed.

Table (7): The total costs of wheat production (in L.E. per fed.) as affected by the different tillage systems and N fertilizer (average of 1998/1999 and 1999/2000 seasons)

Treatment	N levels (kg/fed.)				
	0	30	60	90	120
Zero tillage	1054.8	1107.0	1159.1	1211.4	1263.5
Chisel plow	1098.0	1150.2	1202.3	1254.6	1306.7
Moldboard plow (18-20cm)	1121.8	1174.0	1226.1	1278.4	1330.5
Moldboard plow (28-30cm)	1121.8	1174.0	1226.1	1278.4	1330.5

From Table (7) it is clear that the minimum total cost was that of zero tillage combined with zero level of nitrogen, being 1054.8 L.E. and the maximum total cost was that of moldboard plowing to 18-20 or 28-30cm combined with 120N which was 1330.5 L.E.

E-2: Value of wheat grain yield as affected by the different tillage systems and N fertilizer:

Table (8) shows the value of wheat grain and straw yield as well as total revenue in L.E. per fed. as affected by the different treatments in both seasons. In this estimation the average farmgate price of wheat grain was 107.7L.E./ardab and 174L.E./ton for wheat straw as given by Extension Service information.

From results it is clear that the highest values were 3005.9 and 3162.3 L.E./fed. in 1998/99 and 1999/2000 for moldboarding (28-30cm)X 120N. On the other hand, the lowest values were those of zero tillage combined with zero level of nitrogen, being 1224.4 and1205.9 L.E./fed. with reduction of 1781.5 and1956.4L.E. or 146 and162% compared with the highest treatment in 1998/99 and 1999/2000, respectively.

Table (8): Value of wheat grain and straw yield (inL.E./fed.) as affected by the different tillage systems and N fertilizer.

Treatment	Grain and straw yield values					Total revenue				
	N0	N30	N60	N90	N120	N0	N30	N60	N90	N120
	1998/1999 season									
Zero tillage	879.9 / 344.5	1333.3 / 568.9	1503.5 / 588.1	1716.7 / 655.9	2016.1 / 609.0	1224.4	1902.2	2091.6	2372.6	2625.1
Chisel plow	881.0 / 393.2	1430.9 / 628.1	1573.5 / 664.7	1827.7 / 666.4	2053.8 / 725.6	1274.2	2067.0	2238.2	2494.1	2779.4
Moldboard plow (18-20cm)	1038.2 / 450.7	1697.4 / 628.1	1894.4 / 666.4	1978.4 / 725.6	2122.8 / 746.5	1488.9	2325.5	2560.8	2704.0	2869.3
Moldboard plow (28-30cm)	1089.9 / 645.5	1821.2 / 647.3	1950.4 / 706.4	2057.1 / 734.3	2163.7 / 842.2	1735.4	2468.5	2656.8	2791.4	3005.9
	1999/2000 season									
Zero tillage	878.8 / 327.1	1659.7 / 528.9	1729.7 / 593.3	1853.5 / 635.1	2012.9 / 642.1	1205.9	2188.6	2323.0	2488.6	2655.0
Chisel plow	929.5 / 393.2	1661.8 / 548.1	1785.7 / 609.0	1913.8 / 635.1	2056.0 / 662.9	1322.7	2209.9	2394.7	2548.9	2718.9
Moldboard plow (18-20cm)	1037.2 / 455.9	1766.3 / 588.1	1863.2 / 619.4	1968.8 / 650.8	2096.9 / 805.6	1577.1	2354.4	2482.6	2619.6	2902.5
Moldboard plow (28-30cm)	1121.2 / 509.8	1843.8 / 596.8	1904.1 / 631.6	2026.9 / 789.9	2217.5 / 944.8	1631.0	2440.6	2535.7	2816.8	3162.3

Where: * Numerator: Grain yield value.
* Denominator: Straw yield value.

E-3: Net farm return of wheat production and net return per one invested L.E.:

From results presented in Tables (9 and 10) it is clear that the highest net farm return was recorded by moldboarding (28-30cm) X 120N, being 1675.4 and 1831.8L.E., making a net return ratio of 1.26and1.38 L.E./onc invested pound in the first and second seasons, respectively. The lowest net farm return was that of zero tillage combined with zero level of nitrogen, being 169.6 and151.1L.E./fed. with a net return ratio of 0.16 and 0.14 L.E./onc invested pound in the first and second seasons, respectively.

It could be concluded that under the conditions of the experimental site and from an economic point of view, intensive seedbed preparation including moldboard plowing to 28-30cm combined with applying 120kgN/fed. could be considered among the most important factors which have profound effects on the growth and production of wheat, depressing associated weed competition and improving soil properties resulting in, the highest net farm return.

Table (9):* Net farm return in L.E. per fed. of wheat as affected by the different tillage systems and N fertilizer.

Treatment	1998/1999 season				
	N0	N30	N60	N90	N120
Zero tillage	169.6	795.2	932.5	1161.2	1361.6
Chisel plow	179.2	916.8	1035.9	1239.5	1472.7
Moldboard plow (18-20cm)	367.1	1151.5	1334.7	1425.6	1538.8
Moldboard plow (28-30cm)	613.6	1294.5	1430.7	1513.0	1675.4
	1999/2000 season				
Zero tillage	151.1	1081.6	1163.9	1277.2	1391.5
Chisel plow	224.7	1059.7	1192.4	1294.3	1412.2
Moldboard plow (18-20cm)	455.3	1180.4	1256.5	1341.2	1572.0
Moldboard plow (28-30cm)	509.2	1266.6	1309.6	1538.4	1831.8

***Net farm return (L.E./fed.) = Total return – total costs.**

Table (10):* Net return per one invested L.E.of wheat as affected by the different tillage systems and N fertilizer.

Treatment	1998/1999 season				
	N0	N30	N60	N90	N120
Zero tillage	0.160	0.718	0.804	0.958	1.077
Chisel plow	0.160	0.797	0.861	0.987	1.127
Moldboard plow (18-20cm)	0.327	0.980	1.088	1.115	1.156
Moldboard plow (28-30cm)	0.546	1.102	1.166	1.183	1.259
	1999/2000 season				
Zero tillage	0.143	0.977	1.004	1.054	1.101
Chisel plow	0.204	0.921	0.991	1.031	1.080
Moldboard plow (18-20cm)	0.405	1.005	1.024	1.049	1.181
Moldboard plow (28-30cm)	0.453	1.078	1.068	1.203	1.376

***Net return per one invested L.E.** = $\frac{\text{Net farm return}}{\text{Total costs of poduction (per fed.)}}$

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*إستجابة القمح للنيتروجين تحت نظم الحرث المختلفة

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أجريت تجربتان حقليتان خلال موسمى١٩٩٩/٩٨، ٩٩/ ٢٠٠٠ بمركز التجارب والبحوث الزراعية بكلية الزراعة بمشتهر لدراسة تأثير النظم المختلفة لحرث الارض و التسميد الازوتى على محصول القمح و مكوناته والحشائش المصاحبة وكذلك بعض خواص التربة بالإضافة إلى التقييم الإقتصادى للمعاملات تحت الدراسة. إشتملت التجربة على ٢٠ معاملة عبارة عن التوافق بين أربعة نظم حرث مختلفة (بدون حرث- الحرث بالمحراث الحفار - الحرث بالمحراث القلاب على عمق ١٨-٢٠سم- الحرث بالمحراث القلاب على عمق ٢٨-٣٠سم) وخمسة مستويات من التسميد الازوتى (صفر- ٣٠-٦٠-٩٠-١٢٠ كجم أزوت/ فدان). وفيما يلى أهم النتائج المتحصل عليها:-

١- أدت معاملة الحرث بالمحراث القلاب على عمق ٢٨-٣٠ سم إلى خفض الكثافة الظاهرية بينما زادت النسبة المئوية لمسامية التربة نتيجة المعاملة بالمحراث القلاب على عمقى (١٨-٢٠سم، ٢٨-٣٠ سم).

٢- أظهرت المعاملة بالمحراث القلاب على عمقى الحرث تحت الدراسة تفوقا ملحوظا فى التقليل من إنتشار الحشائش فى القمح.

٣-أدت الزيادة فىمعدلات التسميد الازوتى إلى خفض معنوى لانتشار الحشائش عند عمر ٤٥ يوما من الزراعة وكذلك عند الحصاد.

٤- بلغت أعلى قيمة لمحصول الحبوب و مكوناته (عدد السنابل/م٢ - وزن١٠٠٠ حبة- وزن السنبلة) و كذلك القش للفدان عند المعاملة بالمحراث القلاب على عمقى الحرث تحت الدراسة.

٥- أدت زيادة معدلات التسميد الازوتى إلى زيادة معنوية لمحصول حبوب القمح ومكوناته كذلك محصول القش - ولقد أعطى معدل ١٢٠كجم / فدان أعلى محصول للحبوب.

٦- وجد أن التفاعل بين معاملةالحرث بالمحراث القلاب على عمق ٢٨-٣٠سم والتسميد الازوتى بمعدل ١٢٠ كجم/ فدان قد أدى إلى خفض أنتشار الحشائش فى القمح عند عمر ٤٥ يوم من الزراعة كذلك عند الحصاد.

٧- بلغ صافى الدخل المزرعى لإنتاج القمح أقصاه عند الحرث بالمحراث القلاب على عمق ٢٨-٣٠ سم وإضافة السماد الازوتى بمعدل ١٢٠كجم/فدان.

من النتائج المتحصل عليها تحت ظروف التجربة يمكن التوصية بإعداد الارض لزراعة القمح باستخدام المحراث القلاب على أى من العمقين تحت الدراسة مع إضافة السماد الازوتى حتى معدل ١٢٠كجم/ فدان مع الاخذ فى الإعتبار طبيعة وقوام وخصوبة الارض - حيث أظهرت هذه المعاملات مجتمعة تحسنا ملحوظا لخواص التربة الطبيعة والتقليل من انتشار الحشائش وبالتالى زيادة إنتاجية الفدان من الحبوب و القش كذلك زيادة صافى الدخل المزرعى.