RESULTS AND DISCUSSION

FIRST STUDY

GROWTH AND YIELD OF MAIZE AS AFFECTED BY METHOD OF PLANTING AND THINNING DATE

Table (4): Effect of planting methods on root dry weight of maize plants

Planting methods	Root dry weight			
	1981 season		1982 season	
	First zone (0-15 cm)	Second zone (15-30 cm)	First zone (0-15 cm)	Second zone (15-30 cm)
	................(gm)	....		
Wet method	37.8	5.0	41.3	8.7
Dry method	31.1	4.2	34.3	7.3
Flat method	27.8	3.0	31.7	5.0
L.S.D. 5%	4.9	0.99	9.1	3.4

These increases in root dry weight which were produced by wet planting method could be obtained because the tillage system loosened the soil and increased aeration that allow best root growth (Barber, 1971).

Also, these results are in agreement with those of Kohnke and Barker (1968) who found that tilled plots were three times of root dry weight as those of the untilled plots.

Different results were obtained by Sato et al., (1970) who observed that root growth was heavier in unridged plots than ridged ones.

1.2. Tasseling and silking dates:

Tasseling and silking dates as affected by the various planting methods are presented in table 5.

Results showed that in both seasons, planting methods did not exhibit any significant effect on tasseling and silking dates. However, in both seasons, maize plants grown in wet planting method reached tasseling and silking stages somewhat earlier than those of dry and flat planting methods without a significant difference.

Table (5): Effect of planting methods on the growth characters and flowering of maize plants

Planting methods	Plant height	Ear position	Stem diameter	Leaf area	Time of	
					tasseling	silking
	cm	cm	mm	cm^2	days	
First season (1981)						
Wet method	292.4	155.9	15.68	558.3	62.7	66.6
Dry method	286.4	150.5	15.91	565.4	63.1	67.1
Flat method	279.3	140.0	15.34	547.1	63.3	67.6
L.S.D. 5%	N.S.	11.1	0.33	N.S.	N.S.	N.S.
Second season (1982)						
Wet method	299.1	173.6	17.27	908.3	58.3	62.3
Dry method	291.3	172.5	16.32	855.9	59.1	63.3
Flat method	286.4	168.3	16.60	870.8	59.1	63.3
L.S.D. 5%	N.S.	N.S.	0.59	N.S.	N.S.	N.S.

In the first growing season, maize plants grown in wet method reached tasseling 0.4 and 0.6 day earlier than in dry and flat planting methods. Whereas by using the wet planting method, maize plants reached silking stage earlier by 0.5 and 1.0 day than by using the dry and flat planting methods, respectively. Similar trend was obtained in the second growing season also without a significant difference. These results were in harmony with those reported by Griffith et al., (1973) who observed that tasseling was delayed 2 to 3 days for no-tillage maize as compared to the conventional tillage.

1.3. Plant height:

Plant height was not significantly affected by the applied planting methods in the two growing seasons. However, plants grown under flat method were shorter than wet and dry methods by 13.1 and 7.1 cm, respectively in the first season, corresponding to 12.7 and 4.9 cm in the second season (Table 5).

These results are in agreement with those reported by Misovic and Bozic (1970), Griffith et al., (1973) Thomas et al., (1973), Fink and Wesley (1974), Kang and Yunusa (1977) and Barhoma (1982) who proved that wet method had a little effect in increasing the plant height as compared to the dry planting method.

1.4. Ear position:

The effect of planting methods on the ear position (height on the stem) was significant in the first season, having the same trend in both seasons (Table 5).

It is generally clear that flat planting method produced lower ear position as compared to wet planting. It should be pointed out that dry planting method also produced lower ear position than wet planting without a significant difference.

1.5 Stem diameter:

The effect of planting methods on stem diameter was significant in the two cultivated seasons of 1981 and 1982 (Table 5). Maize plants grown under wet method were significantly superior in stem diameter than those grown under flat planting method in the first season. In the second season, stem diameter of plants grown under wet method exceeded that of plants in dry and flat methods. Similar results were obtained by Kohnke and Barker (1968).

1.6. Leaf area:

Results showed that leaf area of the topmost ear leaf was not significantly affected by the various planting methods (Table 5). Meanwhile, following wet and dry methods had a little effect in increasing leaf area as compared to the flat method. Wilhelm (1980) recorded similar results.

It could be concluded that plants grown under wet planting method were superior in growth characters mainly; root growth, plant height, ear position, stem diameter and leaf area, as well as tasseling and silking dates as compared with dry and flat planting methods. These results could be attributed to the severe N stress during early growth (Kang and Yunusa, 1977 and Kang et al., 1980).

In general, results of Griffith et al., (1973) indicated that as the amount of tillage decreased, plant growth was slowed and maturity was delayed.

2. Effect of planting methods on the yield and yield components:

Data on yield and yield components of maize as affected by planting methods in 1981 and 1982 growing seasons are presented in table 6.

2.1. Ear length:

It was observed that wet and dry planting methods increased the ear length significantly as compared with the flat method in the first season, while in the second season, this increase did not reach the level of significance. Along the same line, Misovic and Bozic (1970) proved that zero-tillage reduced ear length by 6.01% than the conventional cultivation.

Table (6): Effect of planting methods on ear characters of maize

Planting methods	Ear length	Ear diameter	Number of row/ear	Number of kernels/ear	Ear weight
	(cm)	(mm)			(gm)
First season (1981):					
Wet method	14.01	47.3	15.59	571.7	203.5
Dry method	14.15	47.7	15.50	552.1	195.1
Flat method	13.15	47.6	15.50	538.1	193.1
L.S.D. 5%	0.64	N.S.	N.S.	N.S.	N.S.
Second season (1982):					
Wet method	16.5	51.1	16.40	616.7	245.6
Dry method	15.7	51.2	15.9	600.5	246.3
Flat method	15.2	50.4	15.6	586.6	233.0
L.S.D. 5%	N.S.	N.S.	N.S.	N.S.	N.S.

2.2. <u>Ear diameter</u>:

The three planting methods did not exhibit any significant effect on the ear diameter in both of the cultivated seasons (Table 6).

2.3. <u>Number of rows per ear</u>:

Number of rows per ear was not significantly affected by various planting methods as it is clear from table 6.

2.4. <u>Number of kernels per ear</u>:

It was noticed that wet planting method produced the highest number of kernels per ear (571.7 and 616.7 in the first and second growing seasons, respectively) as compared with the dry and flat methods in the two seasons (Table 6). But differences were not significant.

2.5. <u>Ear weight</u>:

Data in table 6 showed that wet planting method produced a slight increase in the ear weight (203.5 and 245.6 gm in the first and second growing seasons, respectively) over dry and flat planting, but these increases were not significant in both seasons. Similar results were obtained by Barhoma (1982) who found that wet and dry methods did not have any significant effect on the ear weight of maize.

2.6. <u>Number of ears per plant</u>:

Data indicated that the planting methods has no any significant effect on the number of ears per plant in both of the studied seasons (Table 7). Okigbo (1973) stated that planting on ridges produced more than one ear per plant.

2.7. Number of plants per plot at harvesting:

There was no significant difference in the number of plants per plot as affected by the various planting methods (Table 7). However, wet planting method had the higher number of plants per plot as compared to dry and flat methods in the two seasons.

Similar results were obtained by Okigbo (1973) and Gupta et al., (1979) who found that ridging improved the emergence of the seelings of maize and sorghum as compared to flat planting. Also, Griffith et al., (1973) found similar conclusion.

2.8. Grain yield per plant:

Results in table 7 indicated that plants grown under wet and dry ridge planting exceeded that of flat planting in the grain weight per plant, which was 166.68 and 189.87 gm in the first and second growing seasons, respectively. However, this increase was significant only in the second season.

Table (7): Effect of planting methods on maize yield and some yield components

Planting methods	Number of harvested plants/plot	Number of ear/plant	Grain yield/ plant	Shelling percent- age %	100-grain weight	Grain yield (tons/ fed.)	Grain yield (ardab/ fed.)	Relative yield
			gm	%	gm	tons		
First season(1981):								
Wet method	93.8	1.09	184.00	83.2	32.8	3.45	24.64	110.57
Dry method	91.9	1.07	174.87	83.2	32.8	3.23	23.07	103.52
Flat method	91.5	1.05	166.68	82.9	32.3	3.12	22.28	100
L.S.D. 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	
Second Season (1982):								
Wet method	98.1	1.06	202.45	83.3	35.9	4.06	29.0	108.26
Dry method	98.0	1.03	196.61	83.1	35.9	3.92	28.0	104.53
Flat method	97.5	1.04	189.87	32.8	35.3	3.75	26.78	100
L.S.D. 5%	N.S.	N.S.	9.02	N.S.	N.S.	N.S.	N.S.	

2.9. Shelling percentage:

Methods of planting did not exert any significant effect on shelling percentage in both of the studied seasons (Table 7). However, results of Rykbost *et al.*, (1967) indicated that ridge planting increased shelling percentage compared to flat planting method.

2.10. Weight of 100 kernels:

In spite of the slight increase in 100-kernel weight that was produced by wet and dry methods as compared with the flat method, the differences among these planting methods were not significant (Table 7).

2.11. Grain yield (tons/fed.):

Results indicated that methods of planting did not significantly affect the grain yield. Wet planting method outyielded the dry and flat methods by 3.5% and 10.6% in the first growing season, respectively, corresponding to 4.5% and 8.3% in the second growing season. However, these increases were not significant (Table 7).

Comparing the effect of planting methods on the grain yields, wet planting method produced the highest yield which was 3.45 and 4.06 t/fed in 1981 and 1982 seasons, respectively. Meanwhile, the lowest yield was obtained by using the flat method (3.12 and 3.75 t/fed in 1981 and 1982 seasons, respectively).

In conclusion, the methods of planting could be arranged with regard to the grain yield obtained on the average of the two growing seasons in a descending order as follows: Wet method (Herati) (26.82 ardab/fed.), dry method (Afir) (25.53 ardab/fed.), and flat method (24.53 ardab/fed.). However, the differences in grain yield were below the level of significance.

This result may be due to the early N stress as mentioned by Kang and Yunusa (1977). Also, it could be due to the favourable effect of wet planting method on the root and shoot growth and yield components as well.

In addition it is well known that wet method of planting helps markedly in the control of weeds, leading to a reduced competition between maize plants and weeds at early stage of growth.

Similar results were obtained by Kohnke and Barker (1968); Misovic and Bozic (1970); Taki (1970) and Okigbo (1973) who reported that maize yield was significantly higher when planted on ridges as compared with the flat planting method. Dzhingov (1975); Neamtu (1976); Kang et al., (1980); Kells et al., (1980) and Wilhelm (1980) found similar results. Also, Barhoma (1982) found that the wet planting method increased the grain yield by 6.3 and 4.7% over the dry method in both of the studied seasons. However, these increases were not significant.

On the other hand, Bone et al., (1976) reported that yield of maize obtained by using zero-tillage system was equal or superior to that of conventional tillage system. While Jones et al., (1969); Shear and Moshler (1969); Minhas (1977); Guerrero and Restropo (1978) noticed that the tillage system did not significantly affect the crop development or yield.

II. EFFECT OF THINNING DATES ON GROWTH CHARACTER, YIELD AND YIELD COMPONENTS OF MAIZE

1. Effect of thinning dates on the growth characters of maize plant:

1.1. Root dry weight:

It is clear from table 8 that the date of thinning had a significant effect on the dry weight of roots especially in the first horizon (0 to 15 cm from the soil surface). Whereas, the effect on the second horizon (15 to 30 cm from the soil surface) was significant in the first season only.

In 1981 growing season, the mean root dry weight was 36.2 and 28.8 gm per plant for thinning at 15 and 30 days from planting, corresponding to 37.9 and 30.9 gm per plant in the second growing season of 1982.

In general, early thinning (15 days from planting) gave the highest dry root weight per plant, while the late ones (30 days from planting) produced the lowest dry weight. These results may be due to the higher plant density per hill at the late thinning date, which caused higher competition among the roots of plants on the given area for water and nutrition and these would reduce the root performance for growth.

Table (8): Effect of thinning dates on the root dry weight of maize plants.

Thinning dates "days after planting"	Root dry weight			
	1981 season		1982 season	
	1st horizon (0-15 cm)	2nd horizon ((15-30 cm)	1st horizon (0-15cm)	2nd horizon (15-30cm)
	←-----(gm)-----→			
15	36.2	5.3	37.9	7.3
20	34.3	4.1	38.4	7.3
25	29.8	3.7	35.7	7.0
30	28.8	3.3	30.9	6.3
L.S.D. 5%	3.0	0.44	6.8	N.S.

1.2. Tasseling and silking dates:

Data shown in table 9 indicated that the time of tasseling and silking were significantly affected by thinning dates in 1981 and 1982 seasons. Days from planting to 50% tasseling were 62.16 and 63.58 days as a result of early (15 days from planting) and late (30 days from planting) thinning dates, respectively in 1981. While in 1982, it was 57.92 and 59.50 days for the early and the later thinning, respectively.

Concerning silking time, it was 66.08 and 62.25 days for the early thinning date in 1981 and 1982 seasons, corresponding to 68.0 and 63.42 days for the later thinning dates in 1981 and 1982 seasons, respectively.

Table (9): Effect of thinning dates on the growth characters of maize plants.

Thinning dates "days after planting"	Plant height (cm)	Ear position (cm)	Stem diameter (mm)	Leaf area (cm^2)	Time of Tasseling	Time of Silking
First season (1981):						
15	297.2	154.0	16.56	624.3	62.16	66.08
20	290.6	152.3	16.31	585.0	62.92	66.75
25	280.7	148.9	15.05	532.1	63.25	67.42
30	275.6	140.0	14.66	486.3	63.58	68.00
L.S.D. 5%	8.6	N.S	0.39	30.4	0.54	0.67
Second season (1982):						
15	301.8	176.83	17.62	924.7	57.92	62.25
20	295.2	172.50	16.95	898.8	58.75	62.83
25	291.2	170.75	16.38	873.2	59.16	63.25
30	280.8	165.75	15.98	816.7	59.50	63.42
L.S.D. 5%	4.7	5.27	0.42	36.10	0.65	0.65

The early thinning which was 15 days from planting resulted in an earlier tasseling and silking times as compared to the later thinning. These differences were significant while the differences between the two later thinnings were not significant in both tasseling and silking dates in all of the studied seasons.

The present results were similar to those obtained by Wooly *et al*., (1962),; Kassem (1964) and Shabana (1967) who found that silking time was delayed by late thinning, also Liu and Chen (1982) reported that later thinning delayed pollination and silking.

1.3. Plant height and ear position:

There was a tendency for the plant height and ear position to be decreased by the late thinning at the later stages of growth (Table 9). Plant height differed significantly in 1981 and 1982 seasons according to thinning dates. Plant heights of 297.2 and 275.7 cm in 1981 and 301.8 and 280.8 cm in 1982 were obtained by thinning at 15 and 30 days post planting, respectively.

Ear position decreased significantly by late thinning in the second season. However, this decrease was not significant in the first season. Ear position was reduced from 154.0 to 140.0 cm in 1981 and from 176.83 to 165.75 in 1982 for thinning at 15 and 30 days from planting.

It could be concluded that early thinning increased plant height and ear position in both seasons. Similar results were obtained by Colville and McGill (1962); Kassem (1964); Shabana (1967); Hallauer and Sears (1969) and Liu and Chen (1982) who observed a decrease in plant height and ear position measurements by thinning at the later stages of growth.

1.4. Stem diameter:

Stem diameter was significantly affected by thinning dates in 1981 and 1982 seasons as it is clear from table 9. Diameter of the internode below the ear was 16.5 mm for thinning at 15 days from planting and 14.66 mm for thinning at 30 days from planting in 1981 season, corresponding to 17.62 and 15.98 mm, respectively in 1982 season. The present results are in general agreement with those obtained by Colville and McGill (1962) and Shabana (1967).

1.5. Leaf area:

The differences in leaf area of the topmost ear for both the growing seasons due to thinning dates were significant (Table 9). The means of leaf area were 624.3 and 486.3 cm^2, in 1981 and 924.6 and 816.7 cm^2 in 1982 as a result of thinning at 15 and 30 days from planting,respectively. The early thinning significantly increased ear leaf area over all of the later thinning dates in 1981 season.

However, in 1982 the ear leaf area difference between the first and second thinning dates did not reach the level of significance. But the effect of early thinning was significant over the other later thinning dates. Similar results were obtained by Stickler (1964); Shabana (1967) and Prine (1971).

2. Effect of thinning dates on the yield and yield components:

2.1. Ear length:

Early thinning treatment had a favourable effect on ear length. The ear length increased significantly by the early thinning, however the difference between the two early thinning dates (15 and 20 days from planting) was not significant in 1981 season. The means of ear length produced by the early and the late thinning were 15.17 and 11.82 cm^2, in 1981, respectively, corresponding to 16.95 and 14.57 cm in 1982 season (Table 10). Similar results were obtained by Liu and Chen (1982).

2.2. Ear diameter:

The early thinning induced a significant increase in ear diameter over all other treatments (Table 10). The mean ear diameter was 49.05 and 45.66 mm for thinning at 15 and 30 days from planting, respectively in 1981 season. These differences in ear diameter were significant, except between the two early thinning dates (15 and 20 days from

Table (10): Effect of thinning dates on the ear characters of maize.

Thinning dates "days after planting"	Ear length (cm)	Ear diameter (mm)	Number of rows/ear	Number of kernels/ ear	Ear weight (gm)
First season (1981):					
15	15.17	49.05	15.48	609.6	211.1
20	14.48	48.48	15.73	598.5	206.9
25	13.43	46.84	14.96	513.6	190.3
30	11.82	45.66	15.16	494.1	180.6
L.S.D. 5%	0.76	0.65	0.47	58.8	5.9
Second season (1982):					
15	16.95	52.25	16.22	652.6	266.1
20	16.13	51.47	16.13	615.8	249.7
25	15.49	50.59	15.91	587.9	233.7
30	14.57	49.25	15.58	548.8	216.7
L.S.D. 5%	0.39	0.41	0.50	29.6	7.6

planting). However, ear diameter was 52.25 and 49.25 mm in 1982 for early and late thinning, respectively, with a significant difference.

It could be concluded that late thinning decreased ear length and diameter. These results are in agreement with those obtained by Wood and Rossman (1956); Hemingway (1957); Shabana (1967) and Liu and Chen (1982) who also found that late thinning decreased ear length.

2.3. Number of rows per ear:

Various thinning dates caused unstable effect on this character (Table 10). The number of rows per ear was 15.48 and 14.96 for thinning at 15 and 25 days from planting, respectively in 1981 season, being 16.22 and 15.58 in 1982 season, with significant differences.

2.4. Number of kernels per ear:

Results in table 10, indicated that there were significant differences in the number of kernels per ear by using various thinning date from planting. There were no significant differences between the two early thinning dates and also between the two late ones, in 1981 season, but in 1982 season, the insignificant difference was between the middle two thinning dates (20 and 25 days from planting) only. The mean number of kernels per ear was 609.6 and 494.1 for the early and the late thinning, in 1981 season, and 652.6 and 548.8 for the same thinning dates in 1982 season.

In conclusion, late thinning caused a decrease in number of kernels per ear, as that was reported by Shabana (1967) and Liu and Chen (1982).

2.5. Ear weight:

Early thinning gave a significant increase in ear weight as compared with late thinning in both of the studied seasons (Table 10). It is clear that the early thinning produced the highest ear weight, while the late thinning produced the lowest ear weight in both seasons. All of the differences obtained were significant except between the two early thinning dates (15 and 20 days from planting), in 1981 season.

In conclusion, there was a general tendency for a gradual decrease in ear weight by any delay in thinning date. This could be due to the intense competition between plants within hills. Similar results were obtained by Kassem (1964); Shabana (1967); Prine (1971) and Baenziger and Glover (1980).

2.6. Number of ears per plant:

Number of ears per plant was significantly affected by the various thinning dates in the first growing season (Table 11). The early thinning gave the highest number of ears per plant, while the late thinning gave the lowest number. This was true for both seasons without significant differences in the second growing season.

Table (11): Effect of thinning dates on maize yield and its components.

Thinning dates "days after planting"	Number of ears/plant	Number of harvested plants/plot	Grain Yield/plant (gm)	Shelling percentage (%)	100-kernel weight (gm)	Grain Yield	
						tons/fed)	(ardab/fed)
First season(1981):							
15	1.09	55.16	188.8	83.55	33.61	3.50	25.0
20	1.08	55.75	184.2	83.45	33.34	3.45	24.64
25	1.08	55.50	171.3	82.89	32.43	3.17	22.64
30	1.03	55.42	156.5	82.64	31.12	2.92	20.85
L.S.D.5%	0.04	N.S.	5.7	0.35	0.42	0.096	
Second season:(1982):							
15	1.06	57.75	211.2	84.24	37.53	4.26	30.42
20	1.05	58.66	202.7	83.51	36.25	4.07	29.07
25	1.05	58.92	188.7	82.59	34.90	3.79	27.07
30	1.04	59.58	172.6	81.96	34.24	3.51	25.07
L.S.D.5%	N.S.	1.03	4.7	0.41	0.77	0.073	

It is obviously clear from the data of the first season that the significant difference in the number of ears per plant was between the early thinning date as compared with the late one.

In general, the early thinning caused an increase in the average number of ears per plant. Similar results were reported by Hussein (1958); Kassem (1964); Shabana (1967) and Prine (1971).

2.7. Number of plants per plot at harvesting:

As shown from table 11, there was no appreciable effect obtained by different thinning dates on the number of plants at harvest. This effect was not significant in 1981. However, in 1982 season, the late thinning date (at 25 and 30 days from planting) increased the number of plants per stand significantly as compared to the early thinning date (at 15 days from planting). Number of plants at harvest was not significantly affected by other thinning dates. **Whereas**, number of plants at harvest was satisfactory in both seasons, which was more than 92 and 95% in the first and second growing seasons, respectively.

The behaviour of this character did not follow any specific trend in 1981. However, it could be clearly detected that the highest number of plants at harvesting was obtained by thinning after 20 and 30 days from planting

The present results are in the same trend with those of Hemingway (1957); Shabana (1967) and Schoper *et al*., (1981).

2.9. Shelling percentage:

Shelling percentage was significantly affected by thinning dates in the two growing seasons, (Table 11).

In 1981, the means of shelling percentage were 83.55 and 82.64 for thinning at 15 and 30 days from planting. However, the differences in shelling percentage between thinning at 15 and 20 days and between 25 and 30 days from planting were not significant.

In 1982, shelling percentages were 84.24 and 81.96 for thinning at 15 and 30 days from planting. All the differences in shelling percentage caused by various thinning dates were significant (Table 11). These results are in agreement with those obtained by Kassem (1964) and Shabana (1967).

2.10. Weight of 100 kernels:

Thinning dates had a significant effect on 100-kernel weight in both seasons (Table 11). While, in 1981 season, there was no significant difference in 100-kernel weight between the early two successive thinnings. However, in 1982, the insignificant difference was only between the later two thinnings.

In general, the early thinning produced the higher 100-kernel weight. There was a tendency for decrease in 100-kernel weight towards delaying thinning in the two growing seasons. Baenziger and Glover (1980) obtained similar result. Also, Liu and Chen (1982) reported that thinning at the 5-leaf stage increased 100-kernel weight than the later thinning stages.

2.12. <u>Grain yield per feddan</u>:

Data in table 11 indicated that thinning dates had a significant effect on the grain yield per feddan in both of the growing seasons.

In the first growing season, the difference in the yield between the early thinnings (15 and 20 days from planting) was not significant owing to the stress soil condition at the first thinning. While yields at 25 and 30 days from planting were significantly lower than in the early two thinnings (15 and 20 days). Yield of the early thinning was higher than that of thinning at 20, 25 and 30 days from planting by 50, 330 and 580 kg/fed., respectively.

In the second growing season, early thinning (15 days from planting) significantly outyielded all the other later thinnings of 20, 25 and 30 days from planting by 190, 470 and 750 Kg/fed., respectively.

Table (12): Yield reduction as a result of postponing thinning date on the average of both seasons 1981 and 1982.

Thinning dates	Yield (ardab/ fed.)	Relative yield	Yield reduction (ardab/ fed.)	Yield reduction %
15	27.71	100.0	-	-
20	26.85	96.89	0.86	3.11
25	24.85	89.67	2.86	10.33
30	22.96	82.85	4.75	17.15

The grain yield as an average of the two growing seasons was 27.71, 26.85, 24.85 and 22.96 ardab/fed. when thinning was practised after 15, 20, 25 and 30 days from planting. The grain yield could be relatively arranged in a descending order in relation to the advance in thinning date as, 100, 97, 90 and 83. Thus, postponing thinning date 5 days (from 15 to 20) reduced the yield by 3%, 10 days (from 15 to 25) reduced the yield by 10%. Further postponing for 15 days (from 15 to 30) resulted in a 17% yield reduction.

The reduction in yield which was produced as a result of the late thinning was in agreement with the results of Pendleton and Dungan (1955) who found that the yield loss increased by increasing the number of the removed plants and by increasing the height of plants at thinning date.

The higher yield which was produced at the early thinning (15 days from planting) could be attributed to the higher quantitative and qualitative characters that were produced at this stage as compared to the other stages. Maize grain yield was decreased as a result of thinning at 20, 25 and 30 days from planting could have resulted from the root damage produced by pulling out the adjacent plants in thinning process (Spencer, 1941). It may be also due to plant competition within each hill prior to thinning (Davidson, 1926). Similar results were obtained by Williams and Welton (1915); Kassem (1964) and Kantrarom (1967) who reported that early thinning tended to produce favour yield.

Also, Shabana (1967) found that early thinning outyielded later thinning by 53.8%. Similar results were obtained by Hallauer and Sears (1969); Price (1971); Baenziger and Glover (1980) and Liu andd Chen (1982) who noticed that early thinning (at 5-leaf stage) increased ear length, grain number per ear, 100-kernel weight and grain yield by 16.9% over the late thinning (at 6-leaf stage).

In general, it could be concluded that the early thinning (15 days from planting) was the best date to eliminate the excess plants. Whereas, the yield tended to decrease when thinning was delayed.

It is also important to apply the first irrigation directly after thinning to avoid what have been happened where the difference in all of the growth characters and yield was not significant by delaying thinning from 15 to 20 days from planting in 1981 growing season, which could be explained by the unsufficient water of the planting irrigation which cause more dryer soil. This was not true in the second growing season, where most of growth characters and yields components were significantly affected as the thinning date changed from 15 to 20 days from planting.

In conclusion, thinning is recommended at 15 days from sowing and irrigation should be applied directly. This recommendation in full agreement with that of Hallauer and Sears (1969) who pointed out that irrigation should be directly applied after any early thinning date to avoid the severe mechanical damage for the roots of the remained seedlings.

III. Interaction effect:

The analysis of variance of the experiment in the two growing seasons showed that the interaction between methods of planting and thinning date had no significant effects on the studied characters. Consequently, the dates were excluded.

Such result indicates that each experimental factor acted independently in affecting all characters studied. In other words, thinning date affected the different growth and yield component characters of maize plants regardless the method of planting. Also early thinning worked positively on maize plants under the three different methods of planting.

With regard to the effect of the interaction for replanting intensity and replanting date on time of tasseling and silking it was clear that such effect was not significant in both seasons.

2 - Plant height and ear position:

Plant height and ear position were markedly affected by the plant population density in one season as shown in tables 13 and 14.

There were no significant differences among various plant densities in the first season. While in the second season, plant height and ear position were significantly affected. It could be concluded that varying the plant density from 100% to 50% stand exerted a marked effect on the plant and ear height. Plant height for unreplanted treatments was 300.7,303.3, 306.0, 301.3, 311.7 and 313.5 cm for 100, 90, 80, 70, 60 and 50% stand in 1981, being 335.7, 339.5, 340.7, 343.3, 346.5 and 347.3 cm, respectively in the second growing season.

Results indicated that increasing plant population density resulted in decreasing plant height and ear position. These results may be due to the unfavourable environmental factors that are required for growth at the higher plant densities, such as light, nutrients and etc.. . Similar results were obtained by Dungan et al., (1958);

Crossman (1967); Moursi et al., (1970); Genter and Camper (1973) and Sorour (1977) who reported that plant height and ear position increased by decreasing plant population densities. However, Crews and Fleming (1965) and Shaheen (1973) found that ear and plant heights were not affected by various plant population densities.

Plant height and ear position were not affected by replanting intensity in the first growing season. While in the second growing season,maize plants showed significant response (Tables 13 and 14). The average plant height was 301.4, 301.0, 302.1, 306.6 and 309.9 cm for 10, 20, 30 40 and 50% replanting intensity in 1981, respectively. The respective values, in 1982, were 338.1, 339.0, 340.8, 343.6 and 344.6 cm. Averages of ear position for 10, 20, 30, 40 and 50% replanting intensities were 165.0, 166.0, 167.3, 168.3 and 170.9 cm in 1981 and were 176.0, 176.7, 178.6, 183.3 and 183.2 cm in 1982, respectively.

Replanting, in general decreased plant height and ear position. Such reduction was only significant in 1982 season.

Time of replanting did not exert marked influence on plant height and ear position in 1981 growing season, but it showed significant effect in the second season (Tables 13 and 14). Plant height was 307.2, 300.4 and 305.1 cm in 1981 and 343.5, 338.8 and 341.1 cm in 1982 for no replanting, early and late replanting, respectively.

3. Stem diameter:

Stem diameter is greatly affected by the different plant population densities in the two growing seasons (Tables 13 and 14). Averages of stem diameter of the unreplanted treatments were 16.2, 16.5, 16.7, 17.2, 17.3 and 18.4 mm for 100, 90, 80, 70, 60 and 50% stand, respectively in the first growing season. In the second growing season the corresponding values were 16.9, 17.6, 18.4, 19.0, 19.3 and 20.1 mm.

It is obviously clear that more healthy plants with higher stem diameter were produced at the lower plant population densities. Stanacer (1962) and Moursi et al., (1970) observed tendency of the stem diameter of maize plant to increase by using greater distance between strips.

Stem diameter was significantly affected by different replanting intensities in the two growing seasons (Tables 13 and 14). There was a general increase in stem diameter as replanting intensities increased. That is because of the more light, nutrients and other environmental factors which are required for growth as previously mentioned. Stem diameter(as average of the three replanting treatments) was 16.5, 16.6, 17.0, 17.1 and 18.1 mm for 10, 20,30, 40 and 50% replanting intensity in 1981 season, respectively, being 17.3, 17.9, 18.4, 18.8 and 19.4 mm in the second growing season of 1982, respectively.

Stem diameter was significantly affected by the various replanting dates in the two growing seasons (Tables 13 and 14). It was 17.2, 16.8 and 17.2 mm for no replanting, early and late replanting (8 and 16 days from planting) , respectively in 1981, being 18.9, 17.8 and 18.4 mm in 1982 growing season.

In other words replanting late at 16 days from planting produced thinner stem diameter of the original plants than with the early replanting (8 days from planting).

The interaction effect of replanting intensity and replanting date had no significant effect on stem diameter of maize plants in both seasons of experimentation.

4. <u>Ear leaf area</u>:

Data in tables 13 and 14 revealed that ear leaf area was significantly affected by plant population densities only in the second season. In general,leaf area increased as plant densities decreased.

The averages of ear leaf area of the unreplanted treatments were 630.3, 649.0, 654.7, 663.0, 651.5 and 677.5 cm^2 for 100, 90, 80, 70, 60 and 50% stand in 1981 season, being 932.7, 998.5, 1042.5, 1033.7, 1101.5 and 1115.5 cm^2 in 1982 season, respectively. These results were in agreement with the results reported by Stickler (1964) and Eik and Hanway (1965).

Results could be explained by the fact that more photosynthesis activities, more photocynthetic products and finally more biomass accompanied the lighter population densities.

Ear leaf area was greatly affected by the different replanting intensities (Tables 13 and 14). The differences were significant only in the second season. The averages of ear leaf area were 639.2, 644.5, 652.9, 664.7 and 676.3 cm^2 at 10, 20, 30, 40 and 50% replanting intensity in 1981, respectively, being 969.3, 990.6, 994.6, 1025.8 and 1040.3 cm^2 in 1982 season.

Replanting as well as time of replanting had a marked effect on the ear leaf area in the second season(Tables 13 and 14). Area of the ear leaf was 659.1, 644.6 and 662.8 cm^2 for no replanting, early and late replanting in 1981, the respective values were 1058.4, 969.4 and 984.5 cm^2 in 1982 season, respectively. However, the differences were significant only in the second season. In other words, replanting after 16 days from planting produced higher ear leaf area as compared to the early replanting (8 days from planting).

Results indicated that no significant interaction effect was detected between intensity and date of replanting on leaf area of the topmost ear in both seasons.

In conclusion, it is obviously clear in the second growing season that the highest plant height (347.3 cm), ear position (187.8 cm), stem diameter (20.1 mm), ear leaf area (1115.5 cm^2) and earlier tasseling and silking were produced by thinning to 50% of the stand after the first week of sowing without any later replanting. Similar trends of these characters were obtained in the first growing season with some exceptions for ear position and ear leaf area.

In general, the observed reduction in plant growth in case of thick stand seemed to be due to the competition between the individual plants and the struggle for available light, nutrients and some of the other essential environmental factors that are required for growth in the surrounding media. This effect could be also produced however, by the increase in the replanting intensities and for each of the early and late replanting.

Plant height and ear position, stem diameter, and leaf area were adversely affected by higher and thicker stand of maize plants. This improved growth characters of plants which were associated with low stand intensity may be due to the less competition of maize plants for the essential requirements of growth as previously mentioned.

While with completing stand by early or late replanting, plants began to suffer from the environmental limitations of plant growth. These environmental limitations, reacted with the changes in number of plants per feddan.

These findings of reduction in growth characters with higher density of maize plants were in agreement with what was reported by Dungan et al., (1958); Hussein (1958); Pumphrey and Dreier (1959); Stanacer (1962); Moursi et al., (1970); Genter and Camper (1973) and Sorour (1977). Also, the low populated plants were better developed than the high populated plants in the morphological characters (Prine, 1971).

II. EFFECT OF INTENSITY AND TIME OF REPLANTING ON THE YIELD AND YIELD COMPONENTS:

1 - Ear characters:

Data collected on the ear characters as affected by different cultural treatments in the two growing seasons are presented in tables 15 and 16.

Ear length and diameter were increased significantly by reducing the plant population density. Ear length for the unreplanted treatments were 14.5, 15.3, 15.6, 16.1, 16.8 and 17.3 cm for averages of 100, 90, 80, 70, 60 and 50% stand in 1981 season, respectively, being 15.6, 16.3, 16.8, 17.3, 17.7 and 17. 9 cm in 1982 season. The respective values for ear diameter were 48.0, 48.8, 48.9, 49.6, 50.8

Table (15): Effect of intensity and time of replanting on the ear characters of the original maize plants in 1981 seaso

Replanting adjust intensity	Time	Ear length (cm)	Ear diameter (mm)	Number of rows/ear	Number of kernels/ear	Ear weight (gm)
50%	A	17.3	51.3	16.2	646.0	266.5
	B	15.6	50.0	16.0	642.0	254.0
	C	16.6	50.4	16.5	684.0	251.7
40%	A	16.8	50.8	16.4	683.5	245.5
	B	15.5	49.4	15.4	613.5	244.3
	C	16.3	49.8	15.7	672.0	239.5
30%	A	16.1	49.6	15.7	604.5	231.0
	B	14.9	49.1	15.2	571.0	228.3
	C	15.6	49.1	15.6	601.5	234.7
20%	A	15.6	48.9	15.7	580.0	222.5
	B	14.8	48.8	15.1	548.7	216.3
	C	15.2	48.7	15.2	580.0	231.3
10%	A	15.3	48.8	14.9	562.7	207.0
	B	14.5	48.1	15.1	541.0	202.7
	C	15.0	48.7	16.2	572.0	221.5
A.No replanting		16.2	49.9	15.8	621.3	234.5
B.Early replanting		15.1	49.1	15.4	583.3	229.1
C.Late replanting		15.7	49.3	15.6	621.9	235.7
Control 100%		14.5	48.0	15.1	540.3	202.5
50 % replanting intensity		16.5	50.5	16.3	667.3	257.4
40% " " "		16.2	50.0	15.8	656.3	243.1
30% " " "		15.5	49.3	15.6	592.3	231.3
20% " " "		15.2	48.8	15.4	569.6	223.3
10% " " "		14.9	48.5	15.1	558.6	210.4
L.S.D. for Replanting intensity at 5%		0.5	0.4	N.S.	19.7	14.7
Replanting time at 5%		0.4	0.3	-	15.3	-
Interaction		-	-	-	-	-

and 51.3 mm in 1981 season and 50.6, 50.4, 51.4, 52.3, 52.6 and 54.1 mm in 1982 season.

In other words, low plant population density was favourable for producing the biggest ears of maize.

Number of rows per ear was not significantly affected by the various plant densities in the two growing seasons. It seems to be that the number of rows per ear is a genetical factor that was not easy to be modified by the various cultural practices.

Number of kernels per ear was influenced by plant population density. It tended to increase by the reduction in plant population density. Averages of number of kernels per ear were 540.3, 562.7, 580.0, 604.5, 683.5 and 676.0 for 100, 90, 80, 70, 60 and 50% stand, respectively in 1981 season, being 607.7, 622.7, 653.5, 661.5, 674.0 and 681.3 in 1982 season.

This increase in the number of kernels per ear as a result of decreasing the plant population density might be due to the increase in ear length and diameter that was produced under the same circumstances and for good pollination, fertilization and better kernel setting.

Ear weight was increased by reducing the plant population density. The averages of ear weight were 202.5, 207.0, 222.5, 231.0, 245.5 and 266.5 gm for 100, 90, 80, 70, 60 and 50% stand in 1981 season. The corresponding values were 237.3, 240.7, 272.3, 271.3, 286.5 and 305.5 gm in 1982 season, respectively. The superiority of ear weight may be due to the increase in ear length and diameter and the increase in the number of kernels per ear.

The good quality of ears obtained at the lowest plant population density was also reported by Hussein (1958); Fayemi (1963); Singh (1967); Galvao et al., (1969); Main et al., (1969) and Singh et al., (1976) who found that ear length, ear diameter, number of kernels per ear and the ear weight were decreased with increasing plant population densities.

Replanting intensities had a marked influence on the ear length and diameter. The differences were significant in the two growing seasons. The highest ear length was 16.5 and 17.3 cm for 50% replanting intensity in 1981 and 1982 seasons, respectively. While the lowest ear length was 14.5 and 15.6 for 100% stand in 1981 and 1982 seasons, respectively. With increase in replanting intensity from 10% to 50% values of ear length and diameter were gradually and significantly increased.

Number of rows per ear was not affected by the various replanting intensities.

Number of kernels per ear was influenced by the replanting intensity and increased significantly by increasing the replanting intensity from 10 to 50%. Similarly, ear weight was significantly increased by increasing the replanting intensities. The averages of ear weight were 210.4, 223.3, 231.3, 243.1 and 257.5 gm for 10, 20, 30, 40 and 50% replanting intensity in 1981 season, being 246.0, 258.2, 267.3, 281.2 and 298.3 gm in 1982 season, respectively.

Similar results were reported by Moursi et al., (1970) who found that the ear characters became greater by increasing replanting intensities.

Both early and late replanting had a marked influence on the ear length and diameter and number of kernels per ear as well.

Replanting in general and early replanting in particular reduced ear characters of maize plants in both seasons. Ear length, ear diameter, and number of kernels per ear were significantly reduced as a result of early replanting in both seasons.

Ear length, diameter, number of rows per ear and number of kernels per ear were 15.1 cm, 49.1 mm, 15.4 and

583.3 for early replanting (8 days from planting), respectively. However, they were 15.7 cm, 49.3 mm, 15.6 and 621.9 for late replanting (16 days from planting) in 1981 season. The corresponding values were 16.2 cm, 51.3 mm, 15.5 and 630.8 for early replanting and 16.5 cm, 51.5 mm, 15.9 and 644.6 for the late replanting in 1982 season (Tables 15 and 16).

Ear weight was not significantly affected by replanting time in the two growing seasons of 1981 and 1982. Ear length, ear diameter, number of rows/ear and number of kernels/ear were not significantly affected by the interaction between replanting intensity and replanting date in both seasons.

2. Number of ears per plant:

Plant population densities exerted a marked effect on the number of ears per plant, as shown in tables 17 and 18. It was clear that at higher population, plants carried the lowest number of ears per plant, while thinner populations were associated with the highest numbers of ears per plant. This trend was true in the two growing seasons. Averages of number of ears per plant were 1.02, 1.02, 1.05, 1.10, 1.16 and 1.25 for 100, 90, 70, 60 and 50% stand, respectively in 1981 season, being 1.0, 1.04, 1.09, 1.17, 1.15 and 1.26 in 1982 season.

Table (17): Effect of intensity and time of replanting on maize yield and some of its components for the original plants in 1981 season.

Replanting adjust intensity	Time	Number of ears/ plant	Grain yield/ plant	Shelling %	100-kernel weight	Grain yield/ fed. original + replanted plant
			gm.		gm.	kg.
50%	A	1.25	276.4	83.5	36.0	2974
	B	1.14	230.8	82.4	34.4	3480
	C	1.15	257.2	82.6	35.1	3225
40%	A	1.16	258.2	83.1	35.5	3205
	B	1.07	216.2	82.3	34.2	3506
	C	1.06	236.5	82.7	34.7	3269
30%	A	1.10	239.4	82.7	34.7	3521
	B	1.04	202.6	82.2	33.8	3633
	C	1.06	218.5	82.6	34.3	3502
20%	A	1.05	227.3	82.6	34.3	3629
	B	1.03	187.6	82.1	33.5	3800
	C	1.04	197.1	82.4	33.8	3645
10%	A	1.02	216.7	82.5	33.8	3757
	B	1.02	174.9	82.1	33.3	3833
	C	1.01	186.8	82.1	33.7	3694
A.No replanting		1.12	243.6	82.9	34.9	3417
B.Early replanting		1.06	202.5	82.2	33.9	3650
C.Late replanting		1.06	219.2	82.5	34.3	3467
Control 100%		1.02	185.0	82.2	33.2	4012
50% replanting intensity		1.18	254.8	82.8	35.2	3226
40% " "		1.09	236.9	82.7	34.8	3326
30% " "		1.06	220.2	82.5	34.4	3552
20% " "		1.04	204.0	82.4	33.9	3691
10% " "		1.01	192.8	82.2	33.6	3761
L.S.D. for Replanting intensity at 5%		0.05	13.1	N.S.	0.2	122
Replanting time at 5%		-	10.2	-	0.2	93
Interaction		-	-	-	-	210.7

Table (18): Effect of intensity and time of replanting on maize yield and some of its components for the original plants in 1982 season.

Replanting adjust intensity	Time	Number of ears/ plant	Grain yield/ plant	Shell- ing %	100-grain weight	Total grain yield/fed. original + replanted plant
			gm.		gm.	Kg.
50%	A	1.26	318.3	83.8	37.5	3185
	B	1.13	274.7	83.5	36.4	3641
	C	1.21	299.7	83.6	36.9	3365
40%	A	1.15	291.0	83.7	36.8	3500
	B	1.06	253.7	83.5	35.9	3733
	C	1.18	266.8	83.6	36.4	3425
30%	A	1.17	263.7	83.6	36.5	3654
	B	1.10	231.7	82.8	35.5	3760
	C	1.12	242.3	83.4	36.2	3575
20%	A	1.09	238.7	83.5	36.1	3765
	B	1.03	216.0	82.7	35.3	3817
	C	1.06	229.0	83.3	35.6	3650
10%	A	1.04	216.7	83.4	35.3	3945
	B	1.00	204.0	82.5	35.0	3883
	C	1.00	209.3	83.2	35.1	3686
A.No replanting		1.14	265.7	83.6	36.4	3609
B.Early replanting		1.06	236.1	83.1	35.6	3766
C.Late replanting		1.11	249.0	83.4	36.0	3540
Control 100%		1.00	204.0	82.5	35.1	4128
50% replanting intensity		1.20	297.6	83.6	36.9	3397
40% " "		1.13	270.5	83.6	36.4	3552
30% " "		1.13	246.9	83.3	36.1	3663
20% " "		1.06	226.3	83.2	35.6	3744
10% " "		1.01	210.0	83.0	35.1	3838
L.S.D. for Replanting intensity at 5%		0.04	6.5	N.S.	0.9	105
Replanting time at 5%		0.03	5.1	-	0.8	81
Interaction		-	-	-	-	182.6

These results could be due to the highest competition between plants in the dense population. Similar results were recorded by Hemingway (1957); Hussein (1958); Main et al., (1969); Downey (1972); Bunting (1973) and Dimitrow (1973).

Replanting intensities had a clear effect on the number of ears per plant as shown in tables 17 and 18. Number of ears per plant became higher as the replanting intensities increased where the original plants were not densed. These results could be attributed to increasing light intercepting as the replanting intensity increased. Replanting in general reduced number of ears per plant with significant differences in the second season.

The effect of replanting date on the number of ears per plant is shown in tables 17 and 18. Late replanting (16 days from planting) exceeded early replanting (8 days from planting) in the average number of ears per plant (of the original plants) only in the second growing season.

In other words, number of ears per plant at late replanting was significantly higher than at the early replanting in the second season. Same trend without significant difference was obtained in the first growing season.

The effect of the interaction between replanting intensity and replanting date on number of ears per plant was not significant in both seasons.

3. Grain yield per plant:

Results for the effect of various plant population densities (50, 60, 70, 80, 90 and 100% stand), replanting intensities to 100% stand and time of replanting on the average grain yield per plant are presented in tables 17 and 18.

Plant population densities exerted a marked effect on the grain yield per plant. Results indicated that plants grown at the higher population densities (control of 100% stand) produced the lowest grain yield per plant which was 185 and 204 gm/plant in the first and second growing seasons, respectively, whereas plants at the lower population (50% stand) produced the highest grain yield per plant which was 276.4 and 318.0 gm in the first and second seasons, respectively.

There was a general increase in the grain yield per plant as the population densities decreased gradually from 100 to 50% stand. Such differences might be due to the highest competition of the plants in the highest population density. Similar results were obtained by Singh (1967) and Downey (1972) who reported that the increase in plant density of maize plants decreased the average grain yield per plant.

Grain yield per plant was greatly affected by different replanting intensities. It became higher as the replanting intensities increased from 10 to 50%, where the original plants were decreased from 100 to 50% and thus plants did not suffer from the competition for the required essential environmental factors as those plants grown under higher replanting intensity.

Replanting intensities of 10, 20, 30, 40 and 50% produced 192.8, 204.0, 226.2, 236.9, 254.8 gm of grains per plant,respectively in the first growing season, being 210.0, 226.3, 246.9, 270.5 and 297.6 gm in the second growing season, respectively. Whereas, the control of 100% stand produced 185.0 and 204.0 gm grain/plant in the first and second growing seasons, respectively (Tables 17 and 18).

Replanting in general and time of replanting in particular significantly affected the grain yield of the original plants (Tables 17 and 18). Grain yield per plant was 243.6, 202.5 and 219.2 gm for no replanting, early and late replanting, respectively in 1981, corresponding to 265.7, 236.1 and 249.0 gm in 1982 season. Such result indicates a great yield reduction per plant due to replanting.

It should be noticed that the late replanting produced higher grain yield per plant for the original plants as compared to the early replanting. This may be due to the fact that late replanting gave more chance for the original plants to grow without great competition as with the early replanting. This caused an early competition for the original plants that was reflected on the grain yield per plant.

The interaction effect between replanting intensity and replanting date on grain yield per plant was not significant in both seasons of experimentation.

4. Shelling percentage:

Data obtained on shelling percentage as affected by different treatments are presented in tables 17 and 18.

Shelling percentage remained about the same in the two growing seasons without pronounced change at the various plant population densities. Similarly, Hemingway (1957); Dungan *et al.*, (1958) and El-Hefnawy (1975) reported that shelling percentage was about almost the same whether the stand was thick or thin.

Also, there were no significant differences in shelling percentage among all of the various replanting intensities (Tables 17 and 18).

Shelling percentage was not significantly affected by replanting date as well as by the interaction of replanting intensity and replanting date in both seasons as it is clear from tables 17 and 18.

5. Weight of 100 kernels:

Plant population density had a marked effect on the 100-kernel weight (Tables 17 and 18).

It is clear that the increase in the plant population density was accompanied by a decrease in weight of 100 kernels. The highest weights (36.0 and 37.5 gm) were obtained at 50% stand in 1981 and 1982, respectively. However, the lowest weights (33.2 and 35.1 gm) were obtained at 100% stand (control) in 1981 and 1982 seasons,respectively.

Results obtained by Bayer and Ywalski (1961); Main et al., (1969); Shaheen (1973) and Sharma (1973) supported the same trend.

Weight of 100 kernels was significantly affected by the various replanting intensities, as shown in tables 17 and 18. The differences among all the replanting intensities were significant in the two growing seasons. Weights of 100 kernels were 33.6, 33.9, 34.4, 34.8 and 35.2 gm for 10, 20, 30, 40 and 50% replanting intensities in 1981 season,respectively, being 35.1, 35.6, 36.1, 36.4 and 36.9 gm in 1982 season.

Different replanting treatments significantly affected the 100-kernel weight (Tables 17 and 18). Weights of 100 kernels were 34.9, 33.9 and 34.3 gm for no replanting, early and late replanting in 1981;respectively, being 36.4, 35.6 and 36.0 gm in 1982 season.

No significant effect for the interaction of replanting intensity and replanting date on the 100-kernel weight in both seasons.

6. <u>Grain yield per feddan:</u>

Results on actual grain yield per feddan (for the original and replanted plants) under the different intensities and dates of replanting are presented in tables 17 and 18.

a. <u>Effect of plant population densities:</u>

Effect of the various plant population densities on the grain yield of the original plants (of the unreplanted treatments) was quite evident in both seasons of experimentation. The grain yield/fed. of the original plants was decreased greatly with the reduction in plant population density. Averages of the grain yield of 100, 90, 80, 70, 60 and 50% plant stand were 4012, 3757, 3629, 3521, 3205 and 2974 kg/fed in the first growing season. The corresponding values in 1982 season were 4128, 3945, 3765, 3654, 3500 and 3185 kg/fed., respectively. Such result indicated a significant continuous decrease in grain yield as the plant population density decreased.

In other words, reducing the stand by 10, 20, 30, 40 and 50% decreased the grain yield, compared with the stand of the control, by 6.4, 9.6,12.3, 20.0 and 26.0%, respectively in 1981 corresponding to 4.5, 8.8, 11.5, 15.2 and 22.9% in 1982.

On the average of both seasons, a stand of maize amounting to 90, 80, 70, 60 and 50% of a 100% stand yielded about 95, 91, 88, 82 and 75% of the complete stand.

The reduction in grain yield by reducing plant population density is mainly attributed to the reduction in the number of the harvested plants.

It is obsiously clear that the yield reduction was more or less about half of the reduction in the stand on a percentage basis.

Thus, a reduction of 10% in the stand resulted in 5% grain yield decrease, and 50% skipping in the stand gave about 25% yield reduction. This less reduction in the grain yield in case of using 50% plant density (stand) was due to the increase in the grain yield of plants that were adjacent to the missed hills in the same row or in the adjacent rows.

It should be noticed that the reduction of some quantitative characters caused by increasing the plant population density was not enough in the magnitude to effect the increase in grain yield that was produced at the higher plant population density.

Yield reduction despite replanting might be due to the unability of the replanted plants to compensate the reduction of plant population density from 100 to 50% and also due to the shading of the replanted hills. These findings were in full agreement with what was reported by Moursi *et al.*, (1970).

c. Effect of replanting dates:

Replanting date had a significant effect on the grain yield of maize in both seasons. In both seasons, early replanting (after 8 days) outyielded significantly both late replanting and unreplanted treatments on the overall average of all replanting intensities. On the other hand, late replanting (after 16 days from planting) did not induce any significant yield increase over the unreplanted treatment on the average of the five replanting intensities.

The early replanted treatments outyielded those of late replanting ones by 183 and 226 kg/fed. in 1981 and 1982, respectively.

Also early replanting outyielded unreplanted treatments by 233 and 157 kg/fed., indicating a significant yield increase for early replanting (after 8 days from planting) on the average of all replanting intensities.

These results could be due to the sowing of missed hills close enough to the proper time, and the less competition of the early replanted plants with the original ones. In addition, their higher growth rate at the best favourable environmental conditions at early season contributes in this result. Results reported by Moursi et al., (1970) support the present results.

d. Effect of the interaction:

Results in tables 17 and 18 indicated a significant effect of the interaction between replanting intensities and replanting dates on the grain yield per feddan in both seasons.

It is clear from the data obtained in 1981 that early replanting resulted in a significant yield increase over unreplanted treatments only at 50 and 40% replanting intensities, where early replanting produced 506 and 301 Kg/fed. grain yield increase. The same trend was obtained in 1982 season, where a significant grain yield increase for early replanting was only obtained at 50 and 40% replanting intensities. Early replanting increased the grain yield by 456 and 233 kg/fed. for the two replanting intensities, respectively in 1982 season.

In both seasons, early replanting produced no significant yield increase at 30, 20 and 10% replanting intensities. Under these three replanting intensities, early replanting produced insignificant yield increase with one exceptional case in 1982 at 10% replanting intensity where early replanting produced even a slight yield reduction (62 kg/fed.).

In 1981, early replanting increased the grain yield over unreplanted treatment by 506 (17%), 301 (9%), 112 (3%), 171 (5%) and 76 (2%) kg/fed. for 50, 40,30, 20 and 10% replanting intensities, respectively. The corresponding increases in 1982 season for early replanting were 456 (14%), 233 (7%), 106 (3%), 52 (1.3%) and -62 (-1.5%) kg/fed. respectively.

It is clear from these results that early replanting was only effective where a great reduction in the stand occurred (50 or 40%). Under 70, 80 and 90% density of the original stand, early replanting showed no significant effect.

These results could be explained by the fact that higher population density of the original plants did not allow a large gap quite enough to permit the replanted hills to grow without smothering and shading effect of the adjacent hills grown by the big plants of the unmissed hills during their early growth.

These results were confirmed by Johnson and Mulvaney (1980) who reported similar conclusion.

Also results showed that late replanting was only effective where 50% of the original stand was skipped. Under 50% replanting intensity, late replanting resulted in a significant grain yield increase of 251 kg/fed. (8.5%) in 1981 and 180 kg/fed. (5.7%) in 1982.

Under 40, 30, 20 and 10% replanting intensities either a slight yield increase or even in most cases a slight yield reduction occurred due to late replanting. Differences in grain yield as a result of late replanting compared with unreplanted treatments were 64 (2%), -19 (-0.5%), 16 (-0.5%), and -63 (-1.7%) kg/fed. in 1982 season. The corresponding values in 1982 season were -75(-2%), -79(-2%), -115(-3%), and -259(-6.6%), respectively.

It is worthmentioning that under 10% replanting intensity (90% stand) late replanting gave a significant yield reduction in the second season, where yield has been reduced by 259 kg/fed. (6.6%) compared with unreplanted treatment due to late replanting. Such result could be explained by the fact that replanting late (after 16 days) gave a chance for growing maize plants with two different ages, the younger plants will suffer under 90% population density from shading and smothering effects and will fail to produce fertile ears. In addition, such young plants will attract a severe infestation with maize stem borers (three different species) and many other insects which will be a source for infesting the original plants. In this concern, such replanted maize plants could be considered more or less as weed plants.

It could be concluded that the present results showed that early replanting (after 8 days) is only recommended if a severe loss in the stand occurred. Early replanting proved beneficial only under 50 and 40% reduction in maize stand. Late replanting (after 16 days) is only beneficial when 50% of the original plants are skipped. Moreover, late replanting may reduce grain yield of maize if the stand is 90 or 80% of the complete (100%) stand.

For clearing the present results, the following tables (19 and 20), show a summary of the data converted into local units (ardab/feddan) as an overall average of the two seasons.

Table(19): Effect of intensity and time of replanting on maize grain yield in ardab/fed.(average of 1981 and 1982 seasons).

Stand	Yield of unreplanted treatments		Yield of early replanting		Yield of late replanting	
	(ardab/fed.)	% relative	(ardab/fed.)	% relative	(ardab/fed.)	% relative
50%	22.0	75.6	25.4	87.3	23.5	80.8
60%	24.0	82.5	25.9	89.0	23.9	82.1
70%	25.6	88.0	26.4	90.7	25.3	87.0
80%	26.4	90.7	27.2	93.5	26.1	89.7
90%	27.5	94.5	27.6	95.0	26.4	90.7
100% control	29.1	100.0	29.1	100.0	29.1	100

Table (20): Yield reduction (in percentage) as a result of the reduced stand on the average of both seasons 1981 and 1982.

Stand reduction	Yield reduction		
	Without replanting	Early replanting	Late replanting
10	5.5 %	5.0%	9.3%
20	9.3 %	6.5%	10.3%
30	12.9 %	9.3%	13.0%
40	17.5 %	11.0%	17.9%
50	24.4 %	12.7%	19.2%

From the tables, it is clear that early replanting is beneficial under 50 and 60% plant density of the original stand, while late replanting is only recommended at 50% population density.

The average of both seasons showed that skipping of 10, 20, 30, 40 and 50% of the original stands reduced the grain yield by 5.5, 9.3, 12.0, 17.5 and 24.4%, respectively.

By early replanting the yield reductions were 5.0, 6.5, 9.3, 11.0 and 12.7%, respectively, being 9.3, 10.5 13.0, 17.9 and 19.2% in the same respective order due to late replanting.

Late replanting may cause negative results where a reduction in grain resulted under 90% maize stand.