# Influence of Tillage Methods on Growth and on Yield of Corn (*Zea mays* L.)

F. A. SOROUR, M. A. EL-SHARKAWY
AND
M. SHAZLI OSMAN[1]

## ABSTRACT

The effect of different tillage practices ranging from minimum (no mechanical cultivation) to maximum (rotary cultivation) on the growth and yield of corn (*zea mays* L.) was studied on the fine sandy soil of Tripoli, Libya. Deep plowing by the 3-disc plow, mouldboard plow and the rotary cultivator retarded the emergence and decreased the number of emerging seedlings. Whereas, the no cultivation and slight harrowing enhanced seedling emergence. There were significant differences in number of emerged seedlings and height of seedlings among the tillage treatments. On the other hand, no significant differences were observed due to tillage in respect to dry-weight of seedling, matured plant height and dry weight of stalks.

There were significant differences in number of ears, length of ears and the yield of ears due to tillage treatments. The highest ear yield of 5.650 kg/plot and the second highest of 4.625 kg/plot were obtained from the 3-disc plowing and the rotary cultivator, respectively. The no mechanical cultivation gave the lowest yield (2.625 kg/plot). Width of ears and kernel size were not significantly affected by the tillage practices.

## INTRODUCTION

It is generally accepted that the two main objectives of tillage operations are namely to control and destroy weeds and to create a suitable seed bed for the growth of crops. Perhaps the former is the most important reason for tillage.

Studies on soil cultivation were conducted in many countries. Noll (4) studying the effect of deep, 12 inches, versus ordinary, 7 inches, plowing found that there was no significant difference between them. However, Swell and Call (6) found that soil plowing in Kansas to a depth of 7 inches gave better yield than plowing to a depth of 3 inches. Overson and Hall (5) reported that there was a gradual increase in yield of wheat as the depth of plowing increases from 4 to 7 inches and that plowing to 10 inches deep did not increase the yield.

[1] *Agronomists and Agricultural Engineer, respectively. Department of Plant Production, Faculty of Agriculture, Tripoli, Libyan Arab Rep.*

Keen (3) conducted cultivation trials over many years at Rothamstead Research Station. The results indicated that there was no significant differences in crop yield obtained from seed beds having different soil structures. Cook (1) obtained similar results from a six year rotation experiment having seven types of seed beds ranging from coarse to fine structures. George and Johnson (2) conducted a six year experiment in Ohio with corn. The seed beds ranged from extreme maximum to minimum tillage. The variations in corn yields were attributed to rain distribution rather than to variations in soil structure.

In general, cultivation studies in temperate regions indicated that there was no significant differences in yields of field crops obtained from various tillage operations. Similar information pertaining to sandy soils as prevailing in Libya is lacking. In fact, there are no standard practices adopted and tillage operations vary considerably. This work is aimed at studying the influence of different tillage practices on the yield of corn.

## MATERIALS AND METHODS

The experiment was carried out on the Faculty of Agriculture Farm, University of Tripoli. The experimental plots were arranged in a super imposed block design with 4 replicates. Each block contained the following tillage treatments; (1) no mechanical cultivation; (2) tine cultivation using a mounted spring tine harrow; (3) disc cultivation using a 7 disc harrow; (4) disc plowing using a 3 disc plow; (5) mouldboard plowing with a 3 bottom general purpose plow; and (6) rotary cultivation. Each plot was 5.0 m long 2.40 m wide. The width was so chosen so as to coincide with the width of the seed drill.

An improved strain of the early American corn variety (*Zea mays* L.) was mechanically sown at a seeding rate of 70 kg/ha. The whole area received sprinkler irrigation at intervals of 7–10 days until maturity.

After three weeks from germination, a thinning operation was performed to give a spacing of 40 cm between plants. An application of 200 kg of ammonium sulphate fertilizer was applied at the time of thinning and again after an interval of 3 weeks. Plant emergence was observed over a period of 15 days. When germination was complete, the number of seedlings for each plot was counted.

The average height of seedlings at the time of thinning was computed by measurements of ten thinned plants taken at random from each plot. However, for dry weight analysis only five plants per plot were chosen at random.

At the maturity stage, the total plant population of each plot was conducted. At the same time, the total plant height as well as the length to the ear node were measured on five plants selected at random from each plot. Harvesting commenced 22 weeks after planting. Data was collected on the length and number of ears, yield weight of grain and straw.

## RESULTS AND DISCUSSION

### I. Plant Growth

Table 1 summarizes the effects of different tillage treatments on plant growth as indicated by their number, height and dry weight both at the seedling and maturity stages. Seedling emergence was generally affected by the tillage treatments. Disc cultivation (treatment 3) resulted in the earliest emergence while disc plowing (treatment 4) retarted it. This might be anticipated since plowing resulted in greater breaking and

Table 1 Effect of tillage treatments on emergence and growth of corn plants.

| Treatment | Number of seedlings per row | Average seedlings height (cm) | Average dry weight of 5 seedlings (gm) | Average plant height (cm) | Average dry weight of stalk per plot (kg) |
|---|---|---|---|---|---|
| (1) No mechanical cultivation | 51 | 27.8 | 18.5 | 173.5 | 11.375 |
| (2) Tine cultivation with spring harrow | 51 | 24.6 | 22.3 | 174.3 | 10.875 |
| (3) Disc plowing with 7 disc harrow | 52 | 30.7 | 22.0 | 194.8 | 15.350 |
| (4) Disc plowing with 3 disc plow | 38 | 26.4 | 17.3 | 209.0 | 14.875 |
| (5) Mouldboard plowing | 46 | 24.4 | 21.3 | 194.3 | 12.125 |
| (6) Rotary cultivation | 46 | 29.4 | 19.3 | 182.0 | 13.000 |
| L.S.D. at 5% | 5 | 2.1 | NS | NS | NS |
| L.S.D. at 1% | 6 | 2.9 | | | |

NS = No significant difference

loosening of the soil at a relatively higher depth than other treatments and hence seeds were deposited at that depth.

Disc cultivation also yielded the highest number of seedlings per row. Significant differences were shown between this treatment and treatments numbers 4, 5 and 6. Also, no cultivation (treatment 1) and tine cultivation (treatment 2) resulted in significantly higher number of seedlings per row than treatments numbers 4, 5 and 6.

Similarly, disc cultivation resulted in plants that gave the highest seedling height. The difference was significant between these and all the other treatments except the rotary cultivation.

The analysis of the dry weight of seedlings, average plant height and the dry weight of stalks from all the treatments did not indicate any significant differences.

## II. Yield and Yield Components

Table 2 shows the effect of the different tillage treatments on grain yield and its components. The no mechanical cultivation treatment produced the lowest number of

Table 2 Effect of tillage treatments on grain yield and its component of corn plants.

| Treatment | Number of ears per plot | Length of ears (cm) | Width of ears (cm) | Yield of ears per plot (kg) | Weight of 1,000 kernels (gm) |
|---|---|---|---|---|---|
| (1) No mechanical cultivation | 16 | 16.3 | 4.1 | 2.625 | 421 |
| (2) Tine cultivation with spring harrow | 18 | 16.8 | 3.7 | 3.400 | 334 |
| (3) Disc cultivation with 7 disc harrow | 28 | 19.3 | 4.1 | 3.950 | 428 |
| (4) Disc plowing with 3 disc plow | 28 | 20.0 | 4.2 | 5.650 | 449 |
| (5) Mouldboard plowing | 21 | 17.0 | 3.8 | 3.325 | 398 |
| (6) Rotary cultivation | 30 | 19.8 | 4.0 | 4.625 | 410 |
| L.S.D..at 5% | 6 | 2.2 | N.S. | 0.388 | N.S. |
| L.S.D. at 1% | 8 | 3.0 | | 0.538 | |

N.S. = No significant difference.

ears per plot. This was also manifested in a reduction in length of ears and yield. On the other hand, disc plowing (treatment 4) gave the highest yield of grain, the longest and widest ears. The difference, in yield and length of ears were significant. However, the rotary cultivation produced the highest number of ears per plot and the second highest grain yield (4.625 kg/plot). The grain yield produced from the disc plowing treatment (5.650 kg/plot) was significantly greater than the yield obtained from the rotary cultivation treatment.

The kernel size as estimated by the weight of 1,000 kernels was not significantly affected by the various tillage treatments. However, the disc plowing treatment resulted in the highest kernel size (449 gm/1,000 kernels).

## LITERATURE CITED

1. Cook, R. H. 1935. Tillage methods influencing crop yield. Soil & Soc. Amm. Proc. 12 : 411–414.
2. George, S. T. and W H. Johnson. 1956. Tillage studies with corn on an Ohio Soil. Soil Sci. Amm. Proc. 20 : 274–278.
3. Keen, B. A. 1925. Studies in Soil Cultivation. J. Agric. Sci. 15 : 375–406.
4. Noll, C. F. 1913. Deep versus ordinary plowing. Penna. Agric. Exp. Sta. Ann. Rept. 39–47.
5. Oveson, M. M. and W. E. Hall. 1957. Long time experiments on eastern oregon wheat land. Oreg. Agric. Exp. Sta. Tech. Bull. pp. 39.
6. Swell, M. C. and L. E. Call. 1925. Tillage investigations relating to wheat production. Kansas Agric. Exp. Sta. Bull. pp. 18.