Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences 3 (4): 403-405, 2004
ISSN 1682-3974
© 2004 Asian Network for Scientific Information

Effects of Different Tillage Techniques on Cotton Yield and Quality

Erdem Aykas and İsmet Önal
Department of Agricultural Machinery, Faculty of Agriculture,
Ege University, Bornova-İzmir, Turkey

Abstract: The objective of this study was to determine the alternative techniques and seed-bed preparation methods and to find out the effects of these methods on yield and quality of cotton. In order to meet the above objectives, laboratory and field experiments were conducted based on randomized block experiment design and two different seeding rates (15 and 30 kg ha^{-1}) were selected. The results of these experiments were found that different soil tillage and seed-bed techniques did not reveal significant differences in seed cotton and leaf quality. It was also found that the precision tillage reduced the traffic on soil and plants grown in these plots emerged earlier.

Key words: Precision tillage, seeding rate

INTRODUCTION

Total planting area of the cotton, which is having great economic potential for Turkey, will reach 1,250,000 ha with GAP (Southern Anatolia Project). So some precautions should be taken and new techniques must be developed to increase the profits by decreasing the costs in cotton production from planting to the harvesting.

In this study, conventional and a new alternative system, precision tillage methods were compared for tillage and seedbed preparation for cotton production and their effects on plant yield and quality were determined.

MATERIALS AND METHODS

In this study, two methods: conventional and new alternative system, precision tillage were applied for cotton production and study was made on a smooth surface for conventional and on ridges for precision tillage method. In conventional tillage, soil was tilled with mouldboard plough at 25 depth and any other application was performed during winter. In spring, soil was ploughed once again at 15 cm depth and discharrowed twice and then float.

In precision tillage application, the same tillage procedure was applied except the spring time tillage. During the spring time, the soil was tilled in a way that the ridges were formed by using a lister. In order to provide and stimulate the necessary moisture movement in the soil, float was used.

Two different seed-rates were applied to the plots on which conventional and precision tillage techniques were applied. The application of these seeding rates was carried out by precision drill with vacuum-disk metering system. The soil was sandy-loam and the literature findings indicated that the soil is mid-level alcaline soil and had low amount of humus and nitrogen but high phosphorus and potassium[1]. In order to compensate the lack of nitrogen in the soil, fertilizer application was made at certain periods of cotton production. Ammonium sulphate at a application rate of 400 kg ha^{-1} was provided during drilling and before first irrigation, ammonium nitrate and triple superphosphate (in rows) and potassium sulphate were applied at a rate of 50, 100 and 150 kg ha^{-1}, respectively. $ZnSO_4 \cdot 7H_2O$ was provided from the leaves of cotton plants at a rate of 50 kg ha^{-1}.

For weed control, trifluralin (2000 cc ha^{-1}) during soil tillage and Basudin 20 Em for leaf press after drilling were used. The cotton seeds used for the experiments were a variety named Nazilli 84 and two different seeding rates (15 and 30 kg ha^{-1}) were metered. Experiments were carried out in the field and the laboratory. In the laboratory, the precision drill was operated at two different seeding rates (15 and 30 kg ha^{-1}) and three different traveling speeds. The theoretical seed spacing for 15 and 30 kg ha^{-1} were calculated to be 4.5 and 9 cm, respectively.

The field experiments were conducted based on randomized block design with four replications. During the field experiments, the two different seeding rates were applied to the plots on which conventional and precision

Corresponding Author: Erdem Aykas, Department of Agricultural Machinery, Faculty of Agriculture, Ege University, Bornova-İzmir, Turkey Tel./Fax: +90 232 342 76 42 E-mail: aykas@ziraat.ege.edu.tr

tillage techniques were used. The measurements in order to identify the differences or similarities between the techniques included the seedling emergence, plant growth, soil temperature, moisture, seed cotton and leaf quality. The effects of different soil tillage techniques were determined based on the measurements made. The experimental field was 0.15 ha and plots were 30 m long and 3.5 m wide. The row spacing was chosen as 76 cm so that machine picking could be possible.

RESULTS AND DISCUSSION

Table 1 shows results from the laboratory test for the performance of the precision drill[2].

As seen from Table 1, operating the drill at 1.5 ms^{-1} traveling speed causes a reduced coefficient of variation and also 80% of the seeds placed in soil was in the theoretical seed spacing. For this reason, this traveling speed was chosen to be the appropriate one for the field experiments.

The soil temperature values obtained from the plots prepared by using conventional and precision tillage techniques after drilling are given in Fig. 1.

As seen from Fig. 1, soil temperature is 1°C higher in the fields where the precision tillage was applied comparing to the fields tilled with conventional tillage methods.

Seedling emergence rate, average seedling emergence times and effective leafing rates were measured, calculated[3,4], as given in Table 2.

According to the variance analysis, tillage systems were found non-significant, whereas, average seedling

Table 1: Performance values of precision drill with he vacuum-disk metering system

	Theoretical number of seeds delivered per revolution of the disk					
	30			60		
Traveling speed (m/s)	1	1.5	2	1	1.5	2
Seed spacing (z) (Cm)	9	9	9	4.5	4.5	4.5
Mean seed spacing (x)	8.5	9.2	9.4	4.7	4.4	5.2
Coefficient of variation (cv) (%)	37.16	31.26	35.82	34.61	29.82	36.28
Doubled seed spacing (%) <0.5z	12.72	9.82	11.26	13.42	10.84	12.14
Blank seed spacing (%) 1.5z >	9.51	6.49	8.38	7.28	6.35	7.79
Accepted seed spacing range (%)	78.12	83.62	80.24	79.18	82.80	80.06

Table 2: Statistical analysis of the field seedling emergence (F.S.E.). Average seedling emergence time (A.S.E.T.) and effective leafing rate (E.L.R.)

	F.S.E. (%)		A.S.E.T.		E.L.R. (%)	
	Avg.	Stat. Grp.	Avg.	Stat. Grp.	Avg.	Stat. Grp.
Conventional						
Z_1 (4,5 cm)	48.55	A	11.18	A	69.79	B
Z_2 (9 cm)	47.87	A	10.95	A	70.47	B
Precision						
Z_1 (4,5 cm)	50.10	A	8.32	B	90.76	A
Z_2 (9 cm)	49.82	A	7.95	B	91.82	A

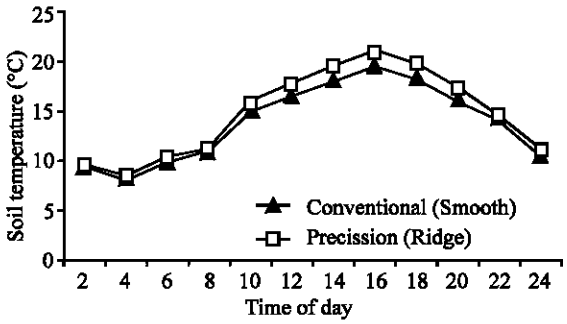

Fig. 1: Soil temperatures measured at different hectares after drilling

Table 3: Plant heights and root lengths of the cotton

	Plant heights								Root lengths							
Measuring time	Conventional				Precision				Conventional				Precision			
(Days after seeding)	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.
10→	5.25	A	5.35	A	5.75	A	5.60	A	3.55	A	3.75	A	3.79	A	3.82	A
20→	7.45	A	7.75	A	7.55	A	7.15	A	5.23	A	5.35	A	5.81	A	5.65	A
30→	12.70	AB	11.85	B	14.45	A	13.35	AB	9.23	B	9.57	B	10.80	A	11.27	A
40→	18.60	B	19.75	AB	21.52	A	21.85	A	13.12	B	11.40	B	17.60	A	17.75	A
During harvest.→	92.10	C	93.42	BC	101.15	AB	102.60	A	26.67	B	27.50	B	34.85	A	33.45	A

Table 4: Cotton yield and early-rising

	Conventional				Precision			
	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.
1. hand (kg ha^{-1})	2598.20	C	2509.70	C	2879.70	A	2765.00	B
2. hand (kg ha^{-1})	800.50	A	781.70	A	651.20	B	646.50	B
3. hand (kg ha^{-1})	503.50	A	496.50	A	424.00	B	402.70	B
Total (kg ha^{-1})	3902.20	A	3787.90	B	3594.90	A	3814.20	B
Early-rising (%)	66.58	B	65.88	B	72.81	A	72.49	A

Table 5: Results of the cotton fibre quality

	Conventional				Precision			
	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.	Z_1 (4.5 cm)	Stat. Grp.	Z_2 (9 cm)	Stat. Grp.
Fibre length	29.40	A	29.35	A	28.78	A	29.46	A
Fiber thickness (Micronaire)	5.03	A	4.91	A	5.10	A	4.93	A
Fiber strength (Presley)	87.39	A	86.71	A	89.39	A	87.93	A
Foreign material (%)	2.17	A	2.25	A	2.35	A	2.12	A

emergence times and effective leafing rates came out significant. The seedling emergence time should be 2 or 3 days earlier in precision tillage methods given in Table 2.

To examine the relations between the plant growth and precision tillage, conventional tillage and the seeding rate, plant heights and root lengths were measured and after evaluation with the variance analysis the results were given in Table 3.

Although there seems there is no difference on the plant heights and the root lengths in first 30 days, plant heights and root lengths were found higher in the plots where the ridge seeding was applied after 30 days or so measurements and the evaluations[5] of (Seed cotton yield) cotton yield and the early application method are given in Table 4.

As seen from Table 4, the first hand cotton yield is higher in early application of precision tillage method. The reduction in the seeding rate reduced the yield to some degree, although there was found no significant relations between the cotton yield and the tillage methods according to the variance analysis. The results of the analysis for fibre quality are given in Table 5.

There was found no statistical significant difference between plots in terms of fibre quality.

As a result, It was well understood that the tillage and the seedbed preparation methods are not causing any difference for cotton yield and the fibre quality. It was found that soil temperature, plant height and the root lengths were higher and the average seedling emergence rate was shorter and also first hand cotton yield was higher in the precision tillage method (ridge seeding).

REFERENCES

1. Balack, G., 1965. Method of soil Analysis. American Society of Agronomy Inc. Pb. Madison Wisconsin USA, pp: 371-383.
3. Bilbro, J.D. and D.F. Wanjura, 1982. Soil Crints end Cotton Emergences Relationship. Transection of the ASAE., 25: 1484-1487/1494.
5. Önal, İ., 1978. Pamuk Seyreltmesinin Mekanizasyon Olanaklari Üzerinde Bir Araştirma. E.Ü.Z.F. Yayinlari, Bornova İzmir, pp: 141-142.
2. Önal, İ., 1995. Ekim Bakim Gübreleme Makinalari. E.Ü.Z.F. Yayinlari, Bornova İzmir, pp: 171-174.
4. Tozan, M. and İ. Önal, 1994. Perlit Uygulamali Domates Ekim Tekniği. Tarimsal Mekanizasyon 15. Ulusal Kongresi Bildiri Kitabi, Antalya, pp: 88-97.