Evaluation of the effects of conservation tillage on field crops productivity and profitability in the Gezira Scheme, Sudan

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ABSTRACT

A permanent experimental site at Gezira Research Station Farm was chosen for five consecutive years (2004/05 to 2008/09), to represent the Gezira Scheme crops rotational serial, which is cotton, wheat, groundnut, sorghum and fallow. The objective was to evaluate the effects of conservation tillage (continuous reridging) on crop productivity and profitability compared to conventional tillage practices for each crop. Each crop was sown with the use of the two tillage systems of land preparation with three replicates. Crops were manually sown using the recommended seed rate, where wheat sowing was done on the top of 80-cm beds in three rows 15-cm apart. The soil bulk density and the corresponding soil moisture content were determined for each crop after the first irrigation(at seedling stage) and at flowering stage at three soil depths. The results indicated no significant differences between the two tillage systems for all crops measured traits. Conservation tillage was found to reduce the cost of production of all the rotational crops in comparison with conventional practices. Accordingly, conservation tillage could be adopted for field crops production in the irrigated schemes located in the Sudan clay plains, provided that the fields are free from perennial weeds and not compacted.

INTRODUCTION

Sudan irrigated schemes are located within the clay plains, where the soils are classified as Vertisols. The irrigated schemes are Gezira, Rahad, New Halfa and Suki. The main rotational crops that are grown in these schemes are cotton (*Gossipiumhirsutum* L. and *G. barbadense* L.), wheat (*Triticum aestivum* L.), groundnut (*Arachishypogaea* L.) and sorghum (*Sorghum bicolor* Moench.). All crops, under surface irrigation system, are grown on the top of 80 cm spaced ridges as a final seedbed preparation. The main objectives of ridge making are to facilitate field irrigation, mitigate crop flooding during the rainy season (July to September) and avoid crust formation that resists crop emergence. This is not 100% true for wheat as a winter crop, as most farmers tend to grow this crop on flat land.

The primary tillage operation for cotton land preparation in the Gezira scheme up to the late 1980s was conducted using a special adapted blade implement drawn by track laying tractors to check the growth of noxious weeds. Due to machinery cost, the use of the blade implement was abandoned (El-Awad, 2000) and replaced by the three-bottom disc plough.

In Abu Naama soil, which is part of Sudan clay plains, El-Awad(1998) found that ploughing time and ploughing depth had no significant effect son increasing kenaf yield. He concluded that the land can be prepared when the soil is workable to a shallow depth (minimum tillage), provided that a fine seedbed is achieved.

In the irrigated Vertisols of Sudan, El-Awad and Dafalla(2012) found that in fields free from perennial weeds of Vertisols, deep and minimum tillage resulted in similar effects on crops growth performance and yields, and that the most economical minimum tillage was quite satisfactory. They stipulated that in the perennial weed-infested fields, seedbed preparation should be done with deep tillage to eradicate perennial weeds since its cost can be compensated by the significant improvement of crop growth performance and yield compared to the minimum tillage system.

The above mentioned findings encourage the adoption of conservation tillage in the irrigated schemes in the Sudan clay plains. The insignificant differences in crops yields were probably due to the nature of the Vertisolic soil type, which is characterized by swelling when wet and shrinking when dry.

This phenomenon results in deep cracks that facilitate soil aeration and deep water percolation, and it is considered as a natural type of soil cultivation. Therefore, the process of soil swelling and shrinking is considered as the main factor that masks the effects of the tillage tool type and tillage system on the crop yield (El-Awad, 2000).

Mechanical ploughing is contributing to the land degradation on a massive scale, particularly in tropical and sub-tropical countries (FAO, 2000). Conservation tillage is a revolutionary cultivation technique in which the fields are not ploughed or ploughed with minimum passes (Hussain *et al*., 1998).Spehar and Souza (1996) defined conservation tillage as the least amount of tillage necessary to provide a good seed bed resulting in quick seed germination and good crop stand. Moreover, the term conservation tillage refers to a number of strategies and techniques where the previous crops residues are purposely left on the surface (Preston, 2003).In conservation tillage systems fewer soil engaging implements are used, which result in lower production costs, lower soil moisture loss and lower soil erosion. Furthermore, retaining crop residue on the soil surface provides a source of plant nutrients, improves organic matter level in the soil, and increases soil water content by reducing evaporation and increasing infiltration rate (Chastin *et al.*,1995).

The present land preparation systems of fields in the irrigated Schemes of Sudan are very expensive with respect to the purchasing price of agricultural machinery. In addition to their high operational cost, this leads to the lowering of economic returns of crops. However, recently minimum tillage or conservation tillage is given high attention worldwide in order to alleviate soil degradation and lower production costs.

After the removal of the crops from the fields, the old ridges can be used for pre-seeding irrigation, thus providing opportunity for initial weed control prior to planting. These ridges can be re-shaped for planting the succeeding crop in the rotation. Moreover, the use of pre- and post-emergence herbicides and the introduction of row crop planters could contribute to a large extend in the adoption of conservation tillage (continuous re-ridging or permanent ridges system) for crop production in the irrigated schemes in the Sudan clay plains.

This study was conducted at the Gezira Research Station Farm for the 5-course crop rotation of the Gezira Scheme with the following objectives:

1. To evaluate the effect of conservation tillage (continuous re-ridging system or permanent ridges) on the yield of various field crops in comparison with conventional seedbed preparation.
2. To evaluate the profitability margin of crop production under the practice of conservation tillage.

MATERIALS AND METHODS

A permanent experimental site at the Gezira Research Station Farm (14°24' N, 33° 29' E and 407 m altitude) was chosen for five consecutive years (2004/05 to 2008/09), so as to represent the Gezira Scheme five crop rotational serials. The soil is classified as Vertisol and it is typicchromuserts, fine, smectitic, isohyperthermic, and is characterized by swelling when wet and shrinking when dry. The physical and chemical properties of the Gezira Research Station Farm soil to a depth of 30 cm as determined by El Tom (1972) are shown in Table 1.

Table 1. Average physical and chemical properties of soil at the Gezira Research Station Farm.

Property	Value	Property	Value
Coarse sand, g/kg	50	N, mg/kg	0.01
Fine sand, g/kg	70	Ca CO3, g/kg	20
Silt, g/kg	210	EC, mS/cm	<3
Clay, g/kg	440	SAR	5
pH paste	7.7	Soluble NA, mmol (+)	12
Organic C%	0.3		

The five-course rotation of the Gezira Scheme is cotton (medium staple, local variety Barac 67), wheat, groundnut, sorghum and fallow. In this rotation, each crop was sown with the use of conservation tillage (continuous re-ridging of the previous ridges) and the conventional land preparation system with three replicates. Subplot size was 10 m × 10 m and the harvested area was 3.2 m × 5 m (4 rows × 5 m). The seed rates for cotton, wheat, groundnut and sorghum were16.7, 143, 71 and 6.3 kg ha^{-1}, respectively.

The conservation tillage system was executed with the use of a four-body ridger to re-shape the previous ridges of 80cm apart to facilitate crop surface irrigation. The conventional land preparation system for each crop was established as shown in Table 2. Moreover, Table 2 shows the ploughing operational cost/ha according to the Gezira Scheme price list for 2008/09 season.

Table 2. Crop seedbed preparation and the operational cost.

Crop	Tillage used for Land preparation	Respective operational cost for 2008/09 season (SDG/ha)	Total cost (SDG/ha) for 2008/09 season
	Conventional land preparation		
Cotton	Disc ploughing + harrowing + leveling + ridging	60 + 36 + 10 + 19	125
Wheat	Ridging in Sept. + harrowing + leveling	19 + 36 + 10	65
Groundnut	Disc harrowing + ridging	36 + 19	55
Sorghum	Disc harrowing + ridging	36 + 19	55
	Conservation tillage		
All crops	Re-ridging only	19	19

Due to the unavailability of seeding machines in the Gezira Research Station, sowing operation of all crops was carried out manually. However, wheat was sown manually on broad 80cm ridges (beds) for both systems of land preparation. In this bed-planting system, the recommended wheat seeds were sown in three rows, 15 cm apart, on the top of 80cm ridges. Each crop

received the recommended cultural input levels under the two types of tillage practice, except that no herbicide was applied for weed control in the cotton plots. For all crops, weeding operation was carried manually.

The soil physical parameters (bulk density and the corresponding soil moisture content) were determined during 2007/08 and 2008/09 seasons for each crop under the two types of tillage practices. Readings were taken after the first irrigation(at seedling stage) and at flowering stage of the crop. Three random soil samples were taken from each treatment using a core sampler of known volume at depths of 0 –10 cm, 10–20 cm and 20–30 cm. The soil moisture content was determined by drying the soil sample in an oven at 105°C for 24 hours. Then, the soil bulk density was determined by dividing the dry sample weight by the core sampler volume. The gravimetric soil moisture content by weight for each corresponding bulk density was calculated. In addition to the determination of crop yield of cotton, wheat, groundnut and sorghum, the average root length of randomly selected 10 plants of cotton per subplot was measured for four seasons only (2005/06 to 2008/09). For wheat, the average plant height of randomly selected 10 plants per subplot was measured. However, for groundnut, the percentage weight of unliftedpods, compared to the potential yield (weight of lifted pods + unlifted pods), was calculated. As for sorghum, plant height was measured for four seasons only (2005/06 to 2008/09) as an average of randomly selected 10 plants per subplot. The data were analyzed using GENSTAT version 15.

RESULTS AND DISCUSSION

Effects on cotton crop productivity

Table 3a shows the effects of conservation tillage and conventional land preparation systems on some soil physical properties (soil bulk density in g/cm^3 and corresponding soil moisture content %) with depth and crop stage for two seasons (2007/08 and 2008/09).Table 3b shows the effects of the two tillage systems on cotton root length (cm) for four consecutive seasons (2005/06 to 2008/09) and cotton yield (kg/ha) for five consecutive seasons (2004/05 to 2008/09).

Table 3a. Effects of tillage systems on soil bulk density (g/cm^3) and soil moisture content (%) of cotton land in relation to depth and crop stage for two seasons (2007/08 and 2008/09).

Tillage system	2007/08 season											
	After 1st irrigation (at seedling stage)						At flowering stage					
	0 – 10 cm		10 – 20 cm		20 – 30 cm		0 – 10 cm		10 – 20 cm		20 – 30 cm	
	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM
CRR	1.07	25.8	1.03	29.1	1.10	35.5	1.17	22.9	1.03	29.2	1.03	28.9
CP	1.03	25.7	1.07	34.4	1.03	33.5	1.07	21.6	1.03	28.9	1.03	29.0
t-calculated	0.30	0.05	0.30	0.76	1.00	1.60	2.12	0.06	0.00	0.11	0.00	0.03
t-tabulated	2.776											
	2008/09 season											
CRR	1.00	16.2	0.93	20.9	1.07	24.2	1.10	12.7	1.13	16.6	1.27	17.4
CP	0.97	22.1	1.33	29.1	1.00	29.3	1.10	12.1	1.13	17.4	1.27	17.4
t-calculated	0.38	3.05	1.37	2.36	1.00	1.76	0.00	0.19	0.00	0.49	0.00	0.00
t-tabulated	2.776											

CRR= Continuous re-ridging. CP = Conventional practice.
BD = Soil bulk density (g/cm^3). SM = Soil moisture content (%).

Although no significant differences were detected between the two land preparation systems for soil bulk density over the two seasons, a significant increase in soil moisture content with conventional tillage ($P\leq 0.05$) compared to conservation tillage existed at the depth of 0 –10 cm, after the first irrigation in 2008/09 season. This could probably be due to the high amount of irrigation water in the preceding irrigation, since there was no hydro flume device to measure the amount of irrigation water. However, as shown in Table 3b, this situation showed no significant effects on crop root length and productivity for the mentioned season. Moreover, no significant effects were detected between the two tillage systems on cotton root length for the four years and crop yields for the five years of study (Table 3b). These results agreed with those of El-Awad (2000)who carried out an experimental work at Maatug Research Substation in the Gezira Scheme. He indicated that, although no differences in cotton growth and yields were detected between deep and shallow tillage, the fast and more economic shallow tillage could replace the expensive and time-consuming deep tillage in Gezira Vertisols. Moreover, neither the deep nor the shallow cotton tillage system had residual effects on the following wheat crop grown in the Gezira heavy clay soils.

Table 3b. Effects of tillage systems on cotton root length (cm) and yield (kg/ha) for five consecutive seasons (2004/05 to 2008/09).

Tillage system	Root length (cm)					Mean
	Seasons					
	2004/05	2005/06	2006/07	2007/08	2008/09	
Continuous re-ridging	N/A	148	172	217	228	191
Conventional practice	N/A	172	187	243	242	211
t-calculated		2.21	0.48	0.98	0.46	
t-tabulated			2.776			
			Yield (kg/ha)			
Continuous re-ridging	0960	1167	0897	1644	1198	1173
Conventional practice	1218	1112	1104	1787	1688	1382
t-calculated	1.23	0.22	1.55	0.42	1.62	
t-tabulated			2.776			

N/A = Not applied.

Effects on wheat crop productivity:

Although there were no significant differences between the two tillage systems on soil bulk density over the two seasons (Table 4a), the conservation tillage resulted in significant increase ($P\leq 0.05$) in soil moisture content in 2008/09 season at the depth of 0–10 cm after the first irrigation, and at the same depth at the flowering stage of wheat (Table 4a). This could probably be due to the same reason stated under the effects on cotton productivity mentioned above.

Table 4a. Effects of tillage systems on soil bulk density (g/cm^3) and soil moisture content (%) of wheat land in relation to depth and crop stage for two seasons (2007/08 and 2008/09).

Tillage system	2007/08 season											
	After 1st irrigation (at seedling stage)						At flowering stage					
	0 – 10 cm		10 – 20 cm		20 – 30 cm		0 – 10 cm		10 – 20 cm		20 – 30 cm	
	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM
CRR	1.10	25.3	1.03	33.1	1.10	36.5	0.97	26.8	1.13	28.6	1.30	34.0
CP	1.13	24.1	1.07	29.9	1.03	32.2	1.07	25.0	1.13	31.3	1.23	34.4
t-calculated	1.00	0.26	0.71	1.11	1.00	1.22	1.34	1.52	0.00	1.06	0.76	0.19
t-tabulated	2.776											
	2008/09 season											
CRR	1.10	19.8	1.13	20.9	1.03	21.3	1.10	20.5	1.07	23.5	1.13	22.7
CP	1.17	17.2	1.10	22.8	1.10	21.3	1.23	12.4	1.07	20.6	1.17	22.8
t-calculated	0.76	3.74	0.50	0.86	1.00	0.00	2.00	4.14	0.00	1.76	0.71	0.05
t-tabulated	2.776											

CRR= Continuous re-ridging. CP = Conventional practice.
BD = Soil bulk density (g/cm^3). SM = Soil moisture content (%).

Moreover, there were no significant differences between the two tillage systems on wheat plant height and productivity for the five seasons of study (Table 4b). Similar results of the effect of land preparation methods for wheat production in Sudan were reported by ICARDA (1987), and Marabet(2000) who reported that grain yields of wheat obtained under no-till were equal to those obtained using a chisel plough or deep tillage. Moreover, at New Halfa Scheme, El-Awad(2004) found that there were no differences in wheat crop yields with various tillage systems of shallow ridging, shallow harrowing and deep tillage systems. This indicated that a suitable and favorable wheat seedbed can be achieved with all tillage systems. He indicated that the more economic shallow tillage system, based on the available shallow tillage implement, could be used for wheat production in the Vertisols of New Halfa scheme.

Table 4b. Effects of tillage systems on wheat plant height (cm) and yield (kg/ha) for five consecutive seasons (2004/05 to 2008/09).

Tillage system	Plant height (cm) seasons					Mean
	2004/05	2005/06	2006/07	2007/08	2008/09	
Continuous re-ridging	47	50	69	31	63	52
Conventional practice	45	51	75	38	63	55
t-calculated	0.71	0.85	0.92	1.43	0	
t-tabulated			2.776			
			Yield (kg/ha)			
Continuous re-ridging	1350	1375	1685	2214	1313	1588
Conventional practice	1479	1293	1596	2203	1320	1578
t-calculated	0.36	0.38	0.32	0.08	0.07	
t-tabulated			2.776			

Effects on groundnut crop productivity:

No significant differences were detected between the two tillage systems for the soil bulk density with depth and crop stage, and their corresponding soil moisture content (Table 5a).

Table 5a. Effects of tillage systems on soil bulk density (g/cm^3) and soil moisture content (%) of groundnut land in relation to depth and crop stage for two seasons (2007/08 and 2008/09).

Tillage system	After 1st irrigation (at seedling stage)						At flowering stage					
	0 – 10 cm		10 – 20 cm		20 – 30 cm		0 – 10 cm		10 – 20 cm		20 – 30 cm	
	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM
2007/08 season												
CRR	1.00	25.6	1.10	26.5	1.10	28.5	1.07	22.7	1.03	28.0	1.07	28.4
CP	1.00	22.7	1.13	27.0	1.13	27.1	1.03	23.8	1.03	30.6	1.07	31.3
t-calculated	0.00	1.15	0.50	0.67	0.50	1.20	0.71	0.45	0.00	1.07	0.00	1.28
t-tabulated	2.776											
2008/09 season												
CRR	1.13	20.1	1.13	26.5	1.13	25.2	1.23	12.2	1.17	16.5	1.17	16.3
CP	1.00	23.9	0.97	27.2	1.00	26.1	1.23	15.7	1.30	16.8	1.10	21.2
t-calculated	2.00	0.76	1.77	0.19	2.00	0.24	0.00	1.95	2.00	0.11	0.76	2.26
t-tabulated	2.776											

CRR= Continuous re-ridging. CP = Conventional practice.
BD = Soil bulk density (g/cm^3). SM = Soil moisture content (%).

Moreover, as shown in Table 5b, there were no significant differences between the two tillage systems for the unlifted pods as a percentage of the potential groundnut yields for the five consecutive seasons, and similarly for the potential crop yield, except in the fifth season (2008/09), where the conventional practice resulted in significantly higher crop yield compared to conservation tillage system.

Table 5b. Effects of tillage systems on un-lifted groundnut pods (%) and yield (kg/ha) for five consecutive seasons (2004/05 to 2008/09).

Tillage system	Un-lifted pods (%) seasons					Mean
	2004/05	2005/06	2006/07	2007/08	2008/09	
Continuous re-ridging	17	31	29	27	33	27
Conventional practice	14	43	27	27	26	27
t-calculated	1.29	1.73	0.19	0.04	1.15	
t-tabulated			2.776			
			Yield (kg/ha)			
Continuous re-ridging	1550	2333	2417	2776	1459	2107
Conventional practice	1714	2157	2333	2865	2073	2228
t-calculated	1.18	0.58	0.22	0.10	3.05	
t-tabulated			2.776			

Effects on sorghum crop productivity:

The two tillage systems resulted in no significant effects on soil bulk density and corresponding soil moisture content with depth and sorghum crop stage (Table 6a).

Table 6a. Effects of tillage systems on soil bulk density (g/cm^3) and soil moisture content (%) of sorghum land in relation to depth and crop stage for two seasons (2007/08 and 2008/09).

Tillage system	After 1st irrigation (at seedling stage)						At flowering stage					
	0 – 10 cm		10 – 20 cm		20 – 30 cm		0 – 10 cm		10 – 20 cm		20 – 30 cm	
	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM	BD	SM
2007/08 season												
CRR	1.10	30.1	1.17	29.8	1.17	33.1	1.10	24.1	1.10	28.3	1.07	30.0
CP	1.00	25.6	0.97	32.8	1.13	35.0	1.03	23.8	1.03	27.8	1.07	27.5
t-calculated	0.87	053	2.68	0.68	0.30	0.43	2.00	0.17	1.00	0.16	0.00	0.78
t-tabulated	2.776											
2008/09 season												
CRR	1.07	21.9	1.07	22.6	1.07	22.7	1.03	21.8	1.13	26.6	1.13	29.7
CP	0.97	20.7	1.07	23.7	1.00	26.6	1.03	22.0	1.13	27.7	1.07	31.9
t-calculated	2.12	0.40	0.00	0.14	1.00	184	0.00	0.07	0.00	0.40	1.41	0.72
t-tabulated	2.776											

CRR= Continuous re-ridging. CP = Conventional practice.
BD = Soil bulk density (g/cm^3). SM = Soil moisture content (%).

Additionally, no significant differences existed between the two tillage systems for sorghum plant height and crop grain yields for the four and five consecutive seasons, respectively (Table 6b). These results were in line with those reported by El-Awad(1982) who found that under rain-fed conditions at Agadi, southern Blue Nile, no significant effects of direct drilling (no-till), one pass of wide level disc harrow at sowing or two passes of wide level disc harrow (one pass at the onset of rain and the second pass at sowing) were found on sorghum grain yield.

Table 6b. Effects of tillage systems on sorghum plant height (cm) and yield (kg/ha) for five consecutive seasons (2004/05 to 2008/09).

Tillage system	Plant height (cm) seasons					Mean
	2004/05	2005/06	2006/07	2007/08	2008/09	
Continuous re-ridging	N/A	125	126	141	128	130
Conventional practice	N/A	123	127	147	141	135
t-calculated		0.78	0.85	0.87	0.82	
t-tabulated			2.776			
			Yield (kg/ha)			
Continuous re-ridging	3420	3420	6087	5554	1853	4067
Conventional practice	2518	3186	5638	6040	1731	3823
t-calculated	1.38	0.95	1.03	1.76	0.21	
t-tabulated			2.776			

Economical evaluation of tillage systems:

The economical evaluation of conservation and conventional tillage systems for seedbed preparation for the various field crops is shown in Table 7. Tillage system costs (TSC), which is shown in the third column of Table 7, are drawn from Table 2. The mean yields of each crop for the five consecutive years, with the use of the two tillage systems, which are shown in the fourth column of Table 7, are drawn from Tables 3b, 4b, 5b and 6b for cotton, wheat, groundnut and sorghum yields, respectively. Moreover, Table 7 displays the results of tillage systems cost of production of one kg of crop (5th column), tillage system cost savings per kg of crop (6th column) and tillage system cost savings per ha (profitability). The production cost of one kg of crop (5th column), was determined by dividing the tillage systems cost (3rd column) by the crop production (4th column). However, the fifth column indicated that the use of conservation tillage (CRR) resulted in a lower cost of production of one kg of each crop in comparison with the conventional practice (CP).The subtraction of CRR tillage system cost from the CP tillage system resulted in tillage systems cost savings for production of one kg of each crop (6th column).Moreover, multiplication of tillage system cost/kg (6th column) by the crop yield/ha (4th column) indicated that the use of continuous re-ridging (CRR) resulted in higher tillage system cost

Table 7. Economical evaluation of conservation and conventional tillage systems of seedbed preparation for various rotational field crops.

Crop	Tillage system	TSC (SDG/ha)	Mean crop yield (kg/ha)	TSC (SDG/kg)	TSC savings (SDG/kg)	TSC savings (SDG/ha)
Cotton	CRR	19	1173	0.016	0.074	86.8
	CP	125	1382	0.090		
Wheat	CRR	19	1588	0.012	0.029	46.1
	CP	65	1578	0.041		
Groundnut	CRR	19	2107	0.009	0.016	33.7
	CP	55	2228	0.025		
Sorghum	CRR	19	4067	0.005	0.009	36.6
	CP	55	3823	0.014		

CRR = Continuous re-ridging.
CP = Conventional practice.
TSC = Tillage system cost.

savings per ha (profitability) in comparison with conventional practice (7th column). This result agreed with that of Jat *et al* (2005) who reported that conservation tillage practices, such as zero and minimum tillage and permanent ridges may be introduced to offset the production cost and other constraints associated with land preparation.

CONCLUSION AND RECOMMENDATION

The results of five years of study indicated that there were no significant differences between the conservation tillage (continuous reridging) and conventional tillage practice on soil bulk density and corresponding soil moisture content, crops performance and yields of rotational field crops (cotton, wheat, groundnut and sorghum). The non-significant differences for all measured traits were due to the type of soil, which is characterized by swelling when wet and shrinking when dry. This phenomenon equalizes the effects of tillage systems and the type of implement used. Moreover, continuous re-ridging (conservation tillage) was found to reduce the cost of production of all rotational crops and resulted in higher cost savings in comparison with the conventional tillage practice. Accordingly, conservation tillage (continuous re-ridging) could be adopted for field crop production in the irrigated schemes located in the clay plains of Sudan provided that the fields are free from perennial weeds and not compacted.

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تقييم تأثير الحراثة الحافظة (فتح السراب المستمر) على إنتاجية وربحية المحاصيل الحقلية في مشروع الجزيرة بالسودان

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الخلاصة

تم اختيار موقع دائم في مزرعة محطة بحوث الجزيرة لمدة خمسة سنوات متتالية (05/2004 إلى 09/2008)، وذلك لتمثيل مسلسل الدورة الزراعية للمحاصيل بمشروع الجزيرة، وهو القطن، القمح، الفول السوداني، الذرة والبور. كانت الأهداف لتقييم آثار الحراثة الحافظة(فتح السراب المستمر) على إنتاجية وربحية المحصول بالمقارنة مع عملية الحراثة السائدة لكل محصول. تمت زراعة كل محصول باستخدام نظامي الحراثة لتحضير الأرض بثلاثة مكررات. كان حجم المربع المزروع 10م×10 م، والمساحة المحصودة 3.2م×5م (4 صفوف×5م). تمت زراعة المحاصيل بمعدل كمية التقاوي الموصي بها يدوياً. وقد تم بذر القمح على قمة مساطب 80 سم بتأسيس ثلاثة صفوف على بعد 15 سم من بعضها البعض. تم تحديد الكثافة الظاهرية للتربة ومحتوى الرطوبة المقابل لها لكل محصول بعد الرية الأولى و في مرحلة الإزهار. أوضحت النتائج عدم وجود فروقات معنوية بين نظامي الحراثة بالنسبة لكل الصفات المقاسة لجميع المحاصيل. كما وجد أن الحراثة الحافظة قد قللت تكلفة الإنتاج مع توفير كبير في تكلفة نظام الحراثة للهكتار بالمقارنة مع ممارسة الحراثة السائدة لكل محاصيل الدورة. وعليه، فيمكن تبني الحراثة الحافظة (فتح السراب المستمر) لإنتاج المحاصيل الحقلية بالمشاريع المروية التي تقع في سهول السودان الطينية، شريطة أن تكون الحقول خالية من الحشائش المعمرة وغير متصلبة.