

# Dedication

**This work is dedicated**  
**to,**  
**The Beloved**  
**country,**  
**My family**  
**And**  
**Friends**  
**With love and loyalty**

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## LIST OF ABBREVIATIONS

RCB	Randomized Complete Block design
CT	Conventional tillage (Disk plowing, offset disk harrowing and leveling).
MTDH	Minimum tillage with offset disk harrow.
MTR	Minimum tillage with rotovator.
MTC	Minimum tillage with field cultivator (Direct seeding).
RP	Minimum tillage with a combined machine (Rotoplanter).
$L_w$	Liquid Limit
$\gamma_{dry}$	Bulk density
$\omega$	Moisture content
$S$	Shear strength
$P_w$	Plastic Limit
ANOVA	Statistical Analysis of Variance
DMRT	Duncan's Multiple Range Test

## **ABSTRACT**

An experiment was conducted in the Demonstration farm of the faculty of Agricultural Studies at Sudan University of Science and Technology for two consecutive seasons (2002/2003 and 2003/2004) to determine the effect of five tillage systems on soil physical and mechanical characteristics and wheat production. These five systems are as follow:

1. Conventional tillage (Disking, Offset disk harrowing and leveling).
2. Tilling with Offset disk harrow.
3. Tilling with Rorovator.
4. Tilling with Field cultivator.
5. Tilling and sowing with a combined machine (Rotoplanter).

The experiment was executed using the Randomized Complete Block Design where the area was divided into four replications and twenty plots of (10×5) m<sup>2</sup> each. Sowing was then done manually for all treatments except for Roroplanter whereas it done mechanically after doing the necessary adjustment.

Application of irrigation water, fertilizers, pesticides and weeding was done equally and simultaneously for all treatments and the results obtained were as follow:

No significant difference was shown regarding the parameters of infiltration rate, bulk density, moisture content and soil resistance to penetration; whereas a significant difference ( $p < 0.05$ ) was revealed in weed population as the highest was in minimum tillage with field cultivator of (153.00 and 151.75) and the lowest was in both conventional tillage and minimum tillage

with rotovator of (96.00 and 92.50) and (83.75 and 93.50) in the first and second season respectively. The results also showed a significant difference in root length and weight of dry roots ( $p < 0.05$ ) whereas the highest value in root length was recorded by both minimum tillage with offset disk harrow and rotovator of (13.38 and 13.75 cm) and (12.48 and 13.50 cm), since the lowest was in minimum tillage with field cultivator of (11.08 and 11.93 cm) in the first and second season respectively. And in weight of dry roots as the highest was also in both minimum tillage with offset disk harrow and rotovator of (1.73 and 1.95 gm) and (2.03 and 1.75 gm), whereas the lowest was in minimum tillage with field cultivator of (1.40 and 1.13 gm) in the first and second season respectively.

The highest production (ton/ha) in the first season was achieved by both minimum tillage with rotovator and offset disk harrow of (3.50 and 3.48 ton/ha) whereas the highest in the second season was given by both minimum tillage with rotovator and conventional tillage of (3.98 and 3.93 ton/ha) respectively. Direct seeding represented by field cultivator and manual sowing had given relatively good results in cracking heavy clay soils compared to other treatments although no herbicides was used.

## الخلاصة

أجريت هذه التجربة بالمزرعة التجريبية لكلية الدراسات الزراعية بجامعة السودان للعلوم والتكنولوجيا خلال موسمين متتاليين (2002/2003 و 2003/2004) لمعرفة اثر خمسة أنظمة لحراثة الارض على بعض الخواص الفيزيائية والميكانيكية للتربة و إنتاجية القمح و قد كانت أنظمة الحراثة كما يلي:

1. حراثة تقليدية (حرث بواسطة المحراث القرصى ثم تكسير بواسطة المشط القرصى المنحرف ثم تسوية بواسطة القصابية).
2. الحراثة بالمشط القرصى المنحرف.
3. الحراثة بالمحراث الدورانى.
4. الحراثة بالعازقة الزمبركية.
5. الحراثة بالآلة المركبة (الحارثة الزراعية).

صممت التجربة على أساس تصميم القطع العشوائية الكاملة حيث تم تقسيم القطعة الزراعية الى أربعة مكررات وعشرون حوضاً بمساحة (10 × 5) م<sup>2</sup> لكل حوض، ثم أجريت عملية الزراعة يدوياً لكل المعاملات فيما عدا للحارثة الزراعية حيث تمت الزراعة آلياً بعد إجراء الضبط اللازم للآلة.

أجريت عمليات الري والتسميد ورش المبيدات الحشرية وعزق الحشائش بصورة متساوية ومتزامنة لكل المعاملات، و قد دلت النتائج على الآتى:

لم تسجل أى فروق معنوية فيما يخص معدل الرشح و الكثافة الظاهرية والمحتوى الرطوبى ومقاومة التربة للإختراق وذلك خلال الموسمين بينما أظهرت النتائج وجود فروق معنوية ( $p < 0.05$ ) فى كثافة الحشائش حيث كان أكثرها كثافة هو الحراثة بواسطة العازقة الزمبركية (153.00 و 151.75) بينما كان أقلها كثافة هو كل من الحراثة التقليدية وأقل حراثة بواسطة المحراث الدورانى (96.00 و 092.5) و (83.75 و 93.5) خلال الموسم الأول والثانى على التوالى، كما أظهرت النتائج أيضاً وجود فروق معنوية ( $p < 0.05$ ) فى طول الجذور والوزن الجاف للجذور حيث كانت أعلى قيمة لطول الجذور فى كل من أقل حراثة بواسطة المشط القرصى المنحرف والمحراث الدورانى (13.38 و 13.75 سم) و (12.48 و 12.50 سم) بينما أقلها قيمة كان فى أقل حراثة بواسطة العازقة الزمبركية (11.08 و 11.93 سم) للموسمين الأول والثانى على التوالى. أما للوزن الجاف للجذور فقد كانت أعلى قيمة أيضاً فى أقل حراثة بواسطة المشط القرصى المنحرف والمحراث الدورانى (1.73 و 1.95 جم) و (2.02 و 1.75 جم) بينما أدنى قيمة كانت فى أقل حراثة بواسطة العازقة الزمبركية (1.40 و 1.13 جم) للموسم الأول والثانى على التوالى.

سجلت أعلى إنتاجية (طن/هكتار) فى كل من أقل حرأة بواسطة المشط  
القرصى والمحراث الدورانى (03.5 و 3.48 طن/هكتار) وذلك خلال الموسم الأول  
بينما فى الموسم الثانى سجلت أعلى إنتاجية فى كل من الحرأة التقليدية و أقل  
حرأة بواسطة المحراث الدورانى (3.98 و 3.93 طن/هكتار) على التوالى. كما أعطى  
البذر المباشرمتمثلاً فى الحرأة بواسطة العازقة الزمبركية والبذر اليدوى نتائج جيدة  
نسبياً فى الاراضى الطينية الثقيلة المتشققة مقارنة مع المعاملات الأخرى  
بالرغم من عدم إستعمال مبيدات الحشائش التى تعتبر ضرورية فى مثل هذا النوع  
من الحرأات.