

# Dedication

To my father (AHMED)

Mother (AMNA)

Sisters(MONA.AMANY.HOWIDA)

Brothers(ALSADIG.ANAS. EMAD.HASHIM)

Friends (AFRAA & REHAB)

To all I love

**Walla**

# Acknowledgement

Praise be to Allah who gave me health, strength and patience to conduct this work. I would like to express my gratitude and appreciation to my main supervisor Dr. **Maysara Ahmed Mohammed** for his consistent supervision and patience, invaluable advice, and guidance throughout the course of study.

I'm indebted to Dr. **Hitham Ragab Elrmlawy** for his invaluable help in the computer model design. I also find myself indebted to Dr. **Hassan Ibrahim** and Dr. **Omran Musa** and Dr **Alsadig Almahadi** and all **Department of Agricultural Engineering Sudan university**. for their invaluable help through the study period.

Finally, I shall be failing in duty if I don't say a word to Eng. **Izzeldin Ahmed** for his invaluable help and continuous encouragement and support all through the study period .and my brothers **Waly Aldeen Alnaeam**, and **Abdelgadir Idriss** although their names didn't appear here simply because they are innumerable.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿٨٣﴾ قُلْ كُلُّ يَعْمَلُ عَلَى شَاكِلَتِهِ ۗ فَرَبُّكُمْ أَعْلَمُ بِمَنْ هُوَ أَهْدَى سَبِيلًا ﴿٨٤﴾ وَتَسْأَلُونَكَ عَنِ الرُّوحِ قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُمْ مِنَ الْعِلْمِ إِلَّا قَلِيلًا ﴿٨٥﴾ وَلَيْنَ شِئْنَا لَنذْهَبَنَّ بِالَّذِي أَوْحَيْنَا إِلَيْكَ ثُمَّ لَا تَجِدُ لَكَ بِهِ عَلَيْنَا وَكِيلًا ﴿٨٦﴾

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

## الخلاصة

(X) القائمة علي بيئة ويندوز (APAMM) تم إعداد برنامج حاسوبي لإدارة الآليات الزراعية (visual basic) أو الأنظمة الحديثة. وهو برنامج سهل الاستخدام كتب علي برنامج 7 أو (إدارة الآليات) يتيح للمستخدم إدخال البيانات المطلوبة لمعالجتها حسابيا كما يمكن المستخدم من استخراج المخرجات التي تظهر علي الشاشة مباشرة .

يتنبأ بالسعة الحقلية لمختلف الآلات الزراعية (هكتار\ساعة)، يحدد قدرة الجر APAMM المطلوبة لكل آلة (كيلو واط) كما يتنبأ البرنامج بعدد الجرارات والآلات المطلوبة لكل عملية زراعية، يحسب التكلفة الكلية للعمليات (هكتار\ساعة) وأيضا يحسب التكلفة الكلية والثابتة لمختلف الدورات الزراعية. يمنح المستخدم خيار شراء أو إيجار الآلة الزراعية .

تم التحقق من صحة البرنامج بالتحليل الإحصائي بالمقارنة مع مشروع الرهد موسم (٢٠٠٦-٢٠٠٧)، وأشارت المقارنة أنه لا توجد فروق معنوية .

يمكن تطبيقه علي أرض الواقع بكل نجاح وثقة. APAMM أشارت النتائج ان

## **ABSTRACT:**

The program APAMM, is a Windows based program that can be run on a Windows xp or higher system on computers. It is a user-friendly interactive program written in a Visual Basic (VB) programming environment for machinery management. It allows the user to interact with it by entering the required inputs and it will carry out the interactive calculations. The program enables the user to print out the output which is displayed on the screen . The APAMM can predict the effective field capacity for different implements(ha/hr), determines the drawbar power needed for each implement (kw),calculates the power take-off power for each implement (kw).Predicts the number of tractors and implements required for each agricultural operation. Calculates the total operation cost per ha, and per hour and finally estimates total costs of owning and operating machinery for various crop rotations, giving the user an option to hire or purchase the machine. APAMM was successfully validated statistically (chi-square)in comparison to Rahad scheme machinery system season 2006-2007. The comparisons indicated that there were no significant differences. In general, the results indicated that the APAMM could be applied to any real-life case successfully and with confidence.

# TABLE OF CONTENTS

DEDICATION	I
ACKNOWLEDGEMENT	II
ARABIC ABSTRACT	IV
ENGLISH ABSTRACT	V
TABLE OF CONTENTS	VI
LIST OF TABLES	IX
LIST OF FIGURES	X
LIST OF ABBREVIATIONS AND NOTATIONS	
<b>CHAPTER I: INTRODUCTION</b>	<b>1</b>
1.1 Background	1
1.2 Problem definition	2
1.3 Study objectives	3
1.4 Specific objectives	4
<b>CHAPTER II: LITERATURE REVIEW</b>	<b>5</b>
2.1 Machinery Management	5
2.2 Computers And Agricultural Machinery Management	6
2.3 Machinery Performance	14
2.4 Machine Field Capacity	15
2.4.1 Theoretical Field Capacity	15
2.4.3 Machine Field efficiency	17
2.5 Tractor Power Performance	19

2.5.1 Implement (machine) power requirements	19
2.5.2 Drawbar Performance	21
2.5.3 Power-Take Off (PTO) power	21
2.5.4 Pto performance	22
2.6 Wheel slippage	23
2.7 Attractive efficiency	24
2.8 Machinery cost	26
2.8.1 Depreciation	27
2.8.2 Interest	29
2.8.3 Taxes, insurance & shelter (tis)	29
2.8.4 Variable costs	30
2.8.5 Repair costs	30
2.8.6 Fuel costs	31
2.8.7 Lubricant	32
2.8.8 Labor	32
2.9 Timeliness Costs	32
2.10 Costs for Implements or Attachments	32
2.11 Factors That Affect the Size of Machinery Needed	33
2.12 Breakeven Point (BEP)	35
2.13 Least Cost Width	35
2.14 Crop Rotation	36
2.15 Advantages of a Crop Rotation	36

<b>CHAPTER III: MODEL DEVELOPMENT</b>	<b>39</b>
3.1 General	39
3.2 Program Development	39
3.3 The Program Assumptions	39
3.4.1 The Program Structure	40
3.4.2 Program Features and Technical Specifications	42
3.5 Data Entry	42
3.7 Tractor /Machine Parameter	47
<b>CHAPTER VII: RESULTS AND DISCUSSION</b>	<b>51</b>
4.1 Model verifications	52
4.2 model validation	53
4.3 Satisfaction of purpose of model building	55
4.4. Sensitivity Analysis	55
4.4.1 Model Response to change in single input	55
4.4.2 . Effect of changing cultivated area	56
4.4.3. Effect of changing machinery purchase price	57
4.4.4. Effect of changing multiple input on model output	59
<b>CHAPTER V CONCLUSION AND RECOMMENDATIONS</b>	<b>61</b>
5.1 Conclusion	61
5.2 Recommendations	62
REFERENCES	63
APPENDIXES	70



## List of Tables

Table	page
2.1 Default values for speed, field efficiency and, draft requirements	9
2.2 Drawbar power estimation in different soil conditions for different tractors	14
2.3 Draft parameters and expected range in draft estimated for tillage and seeding implements	16
4.1 Rahad Scheme Data 2006-2007	52
4.2 Comparison between APAMM and Rahad (170hp tractor)	51
4.3 Comparison between APAMM and Rahad (80HP tractors)	51
4.4 Effect of changing cultivated area in tillage	55
4.5 Effect of changing cultivated area in ridging	56
4.6 Effect of changing cultivated area in planting	56
4.7 Effect of changing machinery purchase price in tillage	57
4.8 Effect of changing machinery purchase price in ridging	57
4.9 Effect of changing machinery purchase price in planting	58
4.10 Effect of changing multiple input on model output in tillage	58
4.11 Effect of changing multiple input on model output in ridging	59
4.12 Effect of changing multiple input on model output in planting	59

## LIST OF FIGURES

<b>figures</b>	<b>page</b>
Fig (2.1) Effect of increasing machinery size on machinery cost	25
Fig(3.1 )APAMM main interface	40
Fig( 3.2) input data for implement	42
Fig (3.3)input data for tractor primary tillage	43
Fig (3.4)input data for tractor secondary tillage	44
Fig (3.5) APAMM general Flow Chart	46

## LIST OF ABBREVIATIONS

### List of Abbreviations and Notations.

<b>Abbreviations and Notations</b>	<b>Full Name</b>
ASAE	American Society of Agricultural Engineering.
TFC	Theoretical field capacity.
EFC	Effective field capacity.
FE	Field Efficiency.
A	Area to be processed.
D	Implement draft.
F	Dimensionless texture adjustment factor.
d	Tillage depth.
$P_{db}$	Drawbar or Propulsion Power
S	Forward or travel speed.
PTO or TOP	Take-off shaft power.
Prot	Rotary power.
pp	Purchase Price.
l	Life on farm.
S v	Salvage value.

tis	Taxes ,insurance and shelter costs.
el	Economic life.
f	Fuel cost .
fp	Fuel price.
0	Oil costs.
Mtc	Machinery total cost.
op	Operation cost
R &m	Repair & Maintenance.
I	Interest rate.
D	Depreciation
SDG	Sudanese giniah