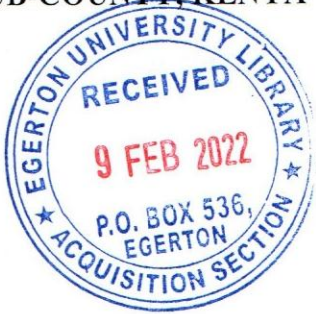


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DETERMINATION OF THE EFFECTS OF CROP ROTATION, WATER HARVESTING AND SOIL FERTILITY MANAGEMENT ON NITROGEN AND WATER USE EFFICIENCY OF WHEAT IN NJORO SUB-COUNTY, KENYA



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ABSTRACT

Wheat production in Njoro Sub – County, Nakuru, Kenya is constrained by many problems including low soil moisture and nitrogen (N) levels resulting in low wheat yields. Thus, the experiments to determine the effects of water harvesting (WH), crop rotation (CR) and soil fertility management (SFM) on N use efficiency (NUE), water use efficiency (WUE) and performance of wheat were conducted at Kenya Agricultural and Livestock Research Organization (KALRO) in Njoro between 2014 and 2016. Three factors were evaluated in a randomized complete block design (RCBD) with split-split plot replicated three times. These factors included (i) two levels of WH (main plot) (flat bed and tie ridge) (ii) four levels of CR (sub-plot) with different crop sequence each year [(CR1= wheat (*Triticum aestivum* – lablab (*Lablab purpureus*) – *T. aestivum*); CR 2= *T. aestivum* –green pea (*Pisum sativum*) - *T. aestivum*); CR 3 =*T. aestivum* –potato (*Solanum tuberosum*) - *T. aestivum*); CR 4 = Continuous wheat for 3 years] and (iii) six levels of SFM (sub-sub-plot) [FYM at 5 t ha⁻¹; green manure (*Leucaena trichandra*) at 2.5 t ha⁻¹; calcium ammonium nitrate (CAN) fertilizer at 25, 50 and 75 kg N ha⁻¹; and untreated control]. Data was subjected to analysis of variance (ANOVA) using Genstat and mean separation was performed using least significance difference (Lsd) at 5% level of significance. Results showed that NUE and NU_pE was improved when (*T. aestivum*) was preceded by either *L.purpureus* or *P. sativum* in the CR treatments. Soil fertility management (SFM) significantly ($p < 0.05$) influenced NUE, NU_tE, NU_pE as well as WUE as well as yield and biomass. Two – way (CR x SFM) interactions significantly ($p < 0.05$) affected NUE, NU_tE, NU_pE as well as WUE and yield of wheat. Green manure (GM) on plots previously occupied by a legume (*L. purpureus*) or *P. sativum*) increased NUE by 46% while NU_pE of wheat was improved by 36% when wheat was grown with the lowest rate (25 kg N ha⁻¹) of inorganic fertilizer on plots that were previously on green pea. The lowest rate of N (25 kg N ha⁻¹) after *L. purpureus* or *P. sativum* improved NU_tE by 14 and 12%, respectively. However, a three – way (WH x CR x SFM) interaction showed significant ($p < 0.001$) effect on WUE and grain yield. Wheat planted with FYM at 5 tonnes ha⁻¹ on flat beds (WH1) previously occupied by *L. purpureus* significantly ($p < 0.05$) increased WUE and grain yield 25% and 31%, respectively. In order to maximize NUE and its attributes *L. purpureus* or *P. sativum* may be used as precursor crops to *T. aestivum* in the CR systems. Organic fertilizer (FYM or GM) positively influenced NUE and its attributes, WUE and grain yield of wheat. This could replace inorganic sources of N if a legume pre-crop to *T. aestivum*.

TABLE OF CONTENTS

DECLARATION AND RECOMMENDATION	ii
COPYRIGHT	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
ABSTRACT	vi
LIST OF TABLES	xiii
LIST OF FIGURES	xiv
LIST OF ABBREVIATIONS AND ACRONYMS	xv
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background Information.....	1
1.2 Statement of the Problem.....	3
1.3 Objectives of the study	4
1.3.1 Broad objective	4
1.3.2 Specific objectives	4
1.4 Hypotheses.....	4
1.5 Justification of the Study	4
1.6 The Scope and limitations of the study.....	5
CHAPTER TWO	6
LITERATURE REVIEW	6
2.1 General overview.....	6
2.1.1 Functions of Nitrogen	7
2.1.2 Nitrogen losses through various processes	8
2.2 Efficient nitrogen use.....	9
2.2.1 Nitrogen Use Efficiency (NUE).....	9
2.2.2 Nitrogen Utilization Efficiency (NUE).....	10
2.2.3 Nitrogen Uptake Efficiency (NUE).....	10
2.3 Consequences associated with low Nitrogen use efficiency (NUE).....	10

2.4	Nitrogen use efficiency (NUE) and its importance in crop production.....	11
2.5	NUE in Agronomy.....	12
2.6	Factors influencing Nitrogen losses.....	14
2.6.1	Management strategies to optimize nitrogen use efficiency (NUE).....	15
2.7	Green manure to enhance N availability.....	19
2.8	Crop rotations to enhance nitrogen use efficiency (NUE).....	20
2.9	Water harvesting.....	21
2.9.1	On-Farm water harvesting technique.....	22
2.10	Effect of water harvesting on nitrogen use efficiency (NUE).....	23
2.11	Water use efficiency (WUE).....	25
2.11.1	Importance of Water- Use Efficiency (WUE).....	26
2.11.2	Effect of Crop management on water use and water use efficiency.....	26
2.11.3	Effect of crop rotation on water use efficiency (WUE).....	27
2.11.4	Effect of nitrogen availability on water use efficiency.....	27
2.12	Summary and knowledge gaps.....	28
CHAPTER THREE.....		29
MATERIAL AND METHODS.....		29
3.1	Description of the study site.....	29
3.2	Treatments.....	30
3.2.1	Water harvesting (WH).....	30
3.2.2	Crop rotation (CR).....	30
3.2.3	Soil Fertility Management (SFM).....	30
3.3	Land preparation and trial establishment.....	31
3.3.1	Land preparation.....	32
3.3.2	Establishment of the experiment.....	32
3.4	Data Collection.....	32
3.4.1	Growth parameters.....	32
3.4.2	Measurements of parameters on wheat (<i>Triticum sativum</i>).....	33
3.4.3	Measurement of parameters on green pea (<i>Pisum sativum</i>) and Dolichos labalab (<i>Lablab purpureus</i>).....	33

3.4.4	Measurements of parameters on potato (<i>Solanum tuberosum</i>).....	34
3.4.5	Determination of soil moisture and temperature	34
3.4.6	Determination of Nitrogen Use Efficiency (NUE) and its components, Nitrogen Uptake Efficiency (NUpE) and Nitrogen Utilization Efficiency (NUtE)	35
3.4.7	Determination of Water Use Efficiency (WUE).....	36
3.5	Soil sampling and preparation	36
3.5.1	Soil analysis	37
3.5.2	General Extraction	37
3.5.3	Determination of soil reaction (pH).....	37
3.5.4	Determination of Soil Organic carbon.....	37
3.5.5	Determination of Total nitrogen	38
3.5.6	Determination of Phosphorous	38
3.5.7	Preparation and chemical characterization of Farm Yard Manure (FYM).....	38
3.6	Data Analysis	39
CHAPTER FOUR.....		41
RESULTS		41
4.1	Rainfall distribution during the experimental period.....	41
4.2	Chemical characterization of Farm yard manure (FYM) and <i>Leuceana trichandra</i> biomass	43
4.3	Mean squares showing the effects of pre-crops in Crop rotation - CR, water harvesting (WH) and soil fertility management (SFM); and their interactions on soil nitrogen (SN), soil organic carbon (SOC), soil moisture (SM), soil temperature (ST) and total water use (TWU).....	43
4.4	Effect of interaction between water harvesting (WH) and season (S) on soil organic carbon (SOC)	45
4.5	Effect of interaction between crop rotation (CR) and season on soil temperature	46
4.6	Effect of interaction between crop rotation (CR) and season on total water use (TWU). 46	
4.7	Effect of interaction between crop rotation (CR) and season (S) on soil nitrogen.....	47
4.8	Effect of interaction between crop rotation (CR) and season (S) on soil moisture	48

4.9	Effect of interaction between soil fertility management and season on soil moisture concentration.....	49
4.10	Effect of interaction between soil fertility management and season on soil nitrogen	50
4.11	Mean squares showing the cumulative effects of crop rotation (CR), water harvesting (WH), soil fertility management (SFM) and their interactions on nitrogen use efficiency (NUE), nitrogen utilization efficiency (NU _t E), nitrogen uptake efficiency (NU _p E) of wheat.....	51
4.12	Cumulative effect of water harvesting (WH) on Nitrogen use efficiency (NUE). Nitrogen utilization efficiency (NU _t E) and Nitrogen uptake efficiency (NU _p E) of wheat.....	52
4.13	Mean squares showing the cumulative effect of crop rotation (CR), water harvesting (WH), soil fertility management (SFM) and their interactions on water use efficiency (WUE), yield and biomass of wheat.....	54
4.14	Effect of water harvesting on water use efficiency (WUE) of wheat.....	55
4.15	Effect of crop rotation (CR) on nitrogen use efficiency (NUE) of wheat	56
4.16	Effect of crop rotation (CR) on nitrogen utilization efficiency (NU _t E)	56
4.17	Effect of crop rotation (CR) on nitrogen uptake efficiency (NU _p E).....	57
4.18	Effect of pre-crop on water use efficiency (WUE) of wheat.....	57
4.19	Interaction effects of crop rotation, water harvesting (WH) and soil fertility management (SFM) on water use efficiency (WUE) of wheat.....	58
4.20	Effect of soil fertility management (SFM) on nitrogen use efficiency (NUE), nitrogen utilization efficiency (NU _t E) and nitrogen uptake efficiency (NU _p E).....	59
4.21	Interaction effect of crop rotation (CR) and soil fertility management (SFM) on nitrogen use efficiency (NUE) of wheat	61
4.22	Interaction effect of crop rotation (CR) and soil fertility management (SFM) on nitrogen utilization efficiency (NU _t E) of wheat.....	62
4.23	Interaction effect of crop rotation (Pre-crop) and soil fertility management (SFM) on nitrogen uptake efficiency (NU _p E) of wheat	63
4.24	Effect of soil fertility management (SFM) on water use efficiency (WUE) of wheat.....	65
4.25	Mean squares showing the effect of crop rotation (CR), water harvesting (WH), soil fertility management (SFM) and their interactions on yield and biomass of wheat.....	66
4.26	Effect of pre-crops in the short crop rotation (CR) on yield.....	67

4.27	Effect of pre-crops in the short crop rotation (CR) on biomass.....	68
4.28	Effect of soil fertility management (SFM) on grain yield of wheat	68
4.29	Effect of soil fertility management (SFM) on biomass of wheat.....	69
4.30	Interaction effects of crop rotation (Pre-crop), water harvesting (WH) and soil fertility management (SFM) on grain yield of wheat	70
4.31	Correlation coefficients depicting relationships between selected soil and water parameters	71
4.32	Correlation coefficient depicting the relationship between yield and NUE plus its associated attributes	72
4.33	Correlation coefficients depicting relationships between WUE and yield; and biomass .	72
4.34	Relationships between yield and selected soil and water parameters.....	73
CHAPTER FIVE		76
DISCUSSION		74
5.1	Rainfall characteristics during long rains in seasons I (2014), II (2015) and III (2016) ..	74
5.2	Effect of water harvesting (WH) on nitrogen use efficiency (NUE), nitrogen utilization efficiency (NU _t E) and nitrogen uptake efficiency (NU _p E) of wheat	74
5.3	Effect of Crop Rotation (CR) on Nitrogen Use Efficiency (NUE), Nitrogen utilization efficiency (NU _t E) and Nitrogen uptake efficiency (NU _p E).....	75
5.4	Effect of soil fertility management (SFM) on Nitrogen use efficiency (NUE) and its associated components (NU _t E and NU _p E)	80
5.5	Effect of water harvesting on water use efficiency (WUE) of wheat	82
5.6	Effect of Crop Rotation on Water Use Efficiency (WUE) of wheat	83
5.7	Effect of soil fertility management on water use efficiency (WUE) of wheat	86
5.8	Effect of water harvesting on wheat yield and biomass	87
5.9	Effect of crop rotation (Pre-crop) on wheat yield and biomass.....	87
5.10	Effect of the soil fertility management (SFM) on yield and biomass of wheat.....	89
5.11	Interaction effect of crop rotation (CR) and soil fertility management (SFM) on nitrogen use efficiency (NUE) and nitrogen uptake efficiency (NU _p E) of wheat	90
5.12	Interaction effect of crop rotation (CR) and water harvesting (WH) on Water use efficiency (WUE).....	92

5.13	Interaction effect of crop rotation (CR) and soil fertility management (SFM) on water use efficiency (WUE).....	93
5.14	Interaction effect of water harvesting (WH) and soil fertility management (SFM) on water use efficiency (WUE)	95
5.15	Interaction effect of crop rotation (CR) and soil fertility management (SFM) on yield ..	96
5.16	Interaction effect of water harvesting (WH) and soil fertility management (SFM) on yield.....	97
5.17	Interaction effect of crop rotation (CR) and water harvesting (WH) on yield	98
CHAPTER SIX		99
CONCLUSIONS, RECOMMENDATIONS AND NEW KNOWLEDGE		99
6.1	Conclusions.....	99
6.2	Recomendations.....	100
6.3	New knowledge contributed by the study.....	101
REFERENCES.....		102
APPENDICES.....		131
Appendix I:	Mean squares showing the effects of factors and their interactions on soil N, soil organic carbon (SOC), soil moisture, soil temperature and total water use (TWU).....	131
Appendix II:	Mean squares showing the cumulative effects of factors and their interactions on NUE, NU_pE , NU_tE and WUE.....	132
Appendix III:	Mean squares showing the effect of factors and their interactions on grain yield and biomass.....	132
Appendix IV:	Treatment combinations for 1 st season (2014).....	133
Appendix V:	Treatment combinations for the 2 nd season (2015).....	135
Appendix VI:	Treatment combinations for the 3 rd season (2016)	137
Appendix VII:	Field Plan For the 2014-Season1	139
Appendix VIII:	Field Plan For the 2015-Season2	139
Appendix IX:	Field Plan For the 2016 – Season3	140
Appendix X:	List of publications	142