EFFECTS OF SOWING DATE ON DAYS TO FLOWERING, YIELD AND GRAIN QUALITY OF SORGHUM (*Sorghum bicolor* L. Moench) IN THE NILE CORRIDOR REGION OF SOUTH SUDAN

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A Thesis Submitted to Graduate School in Partial Fulfilment of the Requirements for the Master of Science Degree in Agronomy of Egerton University.

EGERTON UNIVERSITY

August 2016
DECLARATION AND RECOMMENDATION

Declaration
I declare that the information presented in this text is my original work and no part has ever been submitted for an award of a degree in any University.

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Recommendation
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DEDICATION
This thesis is dedicated to, my parents Mr. and Mrs. Kok, my wife Rebecca and my daughters Jemimah, Esther and Tiffany for their perseverance, love and support during my entire study period.
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ABSTRACT
Sorghum (*Sorghum bicolor* (L.) Moench) is an important crop in the arid and semi-arid lands (ASALs) where moisture is limited and rainfall is erratic. Late sowing, poor yields and lack of adequate nutrition are consistently a problem in South Sudan. The objectives of the study were to 1) determine the effect of sowing date on morphology and yield of sorghum varieties, 2) determine the effects of sowing date on protein, tannins, iron and zinc content of sorghums and 3) identify high yielding sorghum varieties. A field study was conducted under rain fed conditions in Bor and Arek locations of South Sudan. Five varieties; Beer, Akuorachot, Dhet, Agany and Seredo were sown on 18th June, 29th June and 10th July in Bor and Arek locations. The experiment was 2 × 3 × 5 factorial treatments laid out in a randomised complete block design with three replications. Leaf area index, days to flowering, plant height, aboveground biomass, grain yield, harvest index and thousand seed mass were recorded. Laboratory grain quality analyses to determine protein, tannins, iron and zinc contents were conducted. Significant site by variety by sowing date interaction was recorded for leaf area index, days to flowering, plant height, aboveground biomass, grain yield, harvest index and thousand seed mass. At Bor, 18th and 29th June sowing dates recorded mean grain yield of 1.46 and 1.44 t ha⁻¹ but the difference was not significant. However, low yield of 1.15 t ha⁻¹ was obtained for 10th July sowing date. At Arek, 18th June, 29th June and 10th July sowing dates achieved mean grain yield of 2.60, 2.48 and 2.58 t ha⁻¹ but were not statistically different. Variety Akuorachot out yielded other varieties with sites combined overall mean of 2.7 compared to Dhet and Beer with sites combined overall means of 2.36 and 2.18 t ha⁻¹ respectively. Significant positive correlations were recorded between yield and leaf area index, plant height, harvest index and thousand seeds mass. Grain protein content of 11.55 % was achieved for 29th June sowing date in Bor and 11.40 % for 18th June sowing date in Arek. Varieties sown on 18th June had tannin content of 1.19 mg mL⁻¹ while those sown on 10th July had tannin content of 1.49 mg mL⁻¹. Tannin level was 1.37 mg mL⁻¹ in Bor but 1.24 mg mL⁻¹ in Arek. Iron and zinc content was higher for 18th and 29th June sowing dates compared to 10th July sowing. Beer and Dhet were high in protein; Dhet and Seredo were high in iron and zinc while Seredo and Akuorachot were high in tannin content. Inherent variety effect, location and choice of sowing date have associated effects on yield and grain quality of sorghum varieties. Therefore, when Dhet and Akuorachot varieties are sown in June sowing dates yield and grain quality are enhanced.

**TABLE OF CONTENTS**

5
CHAPTER ONE
INTRODUCTION

1.1 Background information

1.2 Statement of the Problem

1.3 Objectives

1.3.1 Broad objective

1.3.2 Specific objectives

1.4 Hypotheses (H₀)

1.5 Justification

CHAPTER TWO
LITERATURE REVIEW

2.1 Description of sorghum

2.1.2 Domestication and distribution

2.1.3 Sorghum growth requirements

2.2 Sorghum development

2.3 Adaptation, stabilities and future prospects of sorghum

2.4 Effects of abiotic stress on sorghum

2.4.1 Photoperiod

2.4.2 Drought stress

2.4.3 Temperature and heat stresses

2.4.4 Flooding and hypoxia

2.5 Effects of season and sowing date on sorghum

2.5.1 Effects of length of a season on sowing date

2.5.2 Effect of sowing date on sorghum and other crops
2.6 Protein content in sorghum .................................................................15
2.7 Tannins content in sorghum ...............................................................16
2.8 Iron and Zinc contents in sorghum ....................................................17
2.9 REFERENCES ....................................................................................19

CHAPTER THREE ......................................................................................29

DAYS TO FLOWERING, YIELD AND YIELD COMPONENTS OF SORGHUM
VARIED AS AFFECTED BY DATE OF SOWING IN SOUTH SUDAN ..............29

ABSTRACT ..................................................................................................29

3.1 INTRODUCTION ..................................................................................30

3.2 MATERIALS AND METHODS ..............................................................31

3.2.1 The study sites, land history and preparation ..................................31
3.2.2 Seeds, sources and experiment design ...........................................33
3.2.3 Data collection ................................................................................34
3.2.4 Statistical analyses ..........................................................................35

3.3 RESULTS ............................................................................................36

Effects of sowing date on days to flowering, yield and yield components of sorghum varieties .............................................36

3.4 DISCUSSIONS ....................................................................................43

3.5 CONCLUSIONS AND RECOMMENDATIONS .....................................46

3.5.1 Conclusions ....................................................................................46
3.5.2 Recommendations ..........................................................................48

3.6 REFERENCES ....................................................................................49

CHAPTER FOUR .........................................................................................52

EFFECT OF SOWING DATE ON GRAIN QUALITY OF SORGHUM VARIETIES 52

ABSTRACT ................................................................................................52

4.1 INTRODUCTION ................................................................................53

4.2 MATERIALS AND METHODS ............................................................55

4.2.1 Site description .............................................................................55
4.2.2 Experiment procedure .................................................................55
4.2.3 Data Analyses .............................................................................56

4.3.1 Effects of sowing dates on sorghum grain quality .........................57
4.3.2 Biochemical mean linkage cluster analysis ...................................64

4.4 DISCUSSIONS ..................................................................................67

4.5 CONCLUSIONS AND RECOMMENDATIONS ...................................70

4.5.1 Conclusions ..................................................................................70
4.5.2 Recommendations .........................................................................71
4.6 REFERENCES ...............................................................................................................
72

CHAPTER FIVE ...............................................................................................................
76

GENERAL DISCUSSION ..................................................................................................76

5.1 CONCLUSION AND RECOMMENDATION ............................................................77

5.1.1 Conclusions ..............................................................................................................77

5.1.2 Recommendations ....................................................................................................78

LIST OF APPENDICES ....................................................................................................79
LIST OF TABLES

Table 3.1. Effects of sowing date on agronomic traits of sorghum varieties grown in Bor and Arek South Sudan during 2015 growing season ..........................................................37
Table 3.2. Agronomic traits of five sorghum varieties evaluated in Bor and Arek, South Sudan during 2015 growing season ..........................................................38
Table 3.3. Correlation coefficients for agronomic traits of sorghum varieties grown in Bor and Arek South Sudan ..............................................................................................................42
Table 4.1. Means for grain % protein content of sorghum varieties as affected by site and date of sowing in Bor and Arek South Sudan .................................................................................59
Table 4.2. Means of tannins content in (mg mL⁻¹) for variety by date interactions for five sorghum varieties in Bor and Arek South Sudan .............................................................................60
Table 4.3. Grain iron content (ppm) of sorghum varieties grown across three different date of sowing in Bor and Arek South Sudan ..............................................................................61
Table 4.4. Grain zinc content (ppm) of sorghum varieties grown across three different sowing dates in Bor and Arek South Sudan ..............................................................................62
Table 4.5. Correlation coefficients for nutritional traits of sorghum varieties grown in Bor and Arek South Sudan during 2015 season .................................................................63
LIST OF FIGURES

Figure 3.1 Generalised map of South Sudan showing major towns including Bor town and Arek sub-county ..........................................................32

Figure 4.1. Dendograms showing mean similarity levels in yield, protein, tannins, iron and zinc content of sorghum as affected by dates of sowing ..........................................................65

Figure 4.2. Dendograms showing mean similarity levels in yield, protein, tannins, iron and zinc content of sorghum varieties ..........................................................66
LIST OF APPENDICES

Appendix 1. Results for soil analyses for sampled soils from Arek and Bor sites before sowing ......................................................................................................................................79
Appendix 2. Rainfall in (mm) recorded during 2015 growing season in Bor and Arek South Sudan. .......................................................................................................................................79
Appendix 3: F test results for homogeneity of variance for data collected in Bor and Arek South Sudan. ........................................................................................................................................80
Appendix 4: SAS procedure used for analyses of agronomic traits of sorghum varieties. ..........................................................................................................................80
Appendix 5: SAS Procedure used for analysis of nutritional qualities of grain for sorghum varieties. .......................................................................................................................................81
Appendix 6. Mean squares for agronomic traits of sorghum varieties grown in Bor and Arek, South Sudan during the 2015 season ........................................................................................................82
Appendix 7: Standard curve for the tannins determination in sorghum flours ..................................................84
Appendix 8. Means squares for the protein, tannins, iron and zinc contents of five sorghum varieties grown at three different dates of sowing in Bor and Arek. ..............................84
# LIST OF ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGBM</td>
<td>Aboveground dried biomass</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of variance</td>
</tr>
<tr>
<td>ASALs</td>
<td>Arid and semi-arid lands</td>
</tr>
<tr>
<td>BHEARD</td>
<td>Borlaug higher education for agricultural research and development</td>
</tr>
<tr>
<td>CE</td>
<td>Catechin equivalent</td>
</tr>
<tr>
<td>CGR</td>
<td>Crop growth rate</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation</td>
</tr>
<tr>
<td>ICRISAT</td>
<td>International crop research institute for the semi-arid tropic</td>
</tr>
<tr>
<td>IFPRI</td>
<td>International food policy research institute</td>
</tr>
<tr>
<td>ITCZ</td>
<td>Inter-tropical convergent zone</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and agriculture organization</td>
</tr>
<tr>
<td>m.a.s.l</td>
<td>Metres above sea level</td>
</tr>
<tr>
<td>NAR</td>
<td>Net assimilation rate</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per millions</td>
</tr>
<tr>
<td>UPGMA</td>
<td>Unpaired group mean linkage cluster analysis.</td>
</tr>
<tr>
<td>USAID</td>
<td>United States agency for international development</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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<tr>
<td>WFP</td>
<td>World food program</td>
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