

**The comparative role of intervening and independent variables in the adoption  
behaviour of maize growers in Njombe District, Tanzania**

by

**Catherine Phillip Msuya**

**Submitted in partial fulfillment of the requirements for the degree of Doctor of  
Philosophy in Agricultural Extension**

**In the Faculty of Natural and Agricultural Science**

**University of Pretoria**

**Pretoria**

**June, 2007**

## ABSTRACT

*The ongoing quest for a better understanding of adoption behaviour, and more specifically the search for relevant, and meaningful behaviour determinants that can be useful in the understanding, analysis and change of adoption behaviour, has prompted this study. It was specifically focused on the role of intervening variables and their influence relative to the commonly used independent variables. A pre-tested, structured questionnaire was used to collect data from 113 farmers randomly selected to represent five percent samples of four villages selected to represent the biggest variation in terms of climatic conditions within the Njombe district of Tanzania. Correlations, chi-square, and regressions were used to determine the relationship between the independent and the dependent variables. The results show that most of the farmers' (97.3 percent) production efficiency falls well below the optimum maize yield of about 40 bags per acre. Various independent and intervening factors were found to influence adoption. In general, the intervening variables show, without exception, much stronger influence relationships with adoption behaviour than is the case with independent variables. Also, unlike what is a common phenomenon among independent variables, these relationships show great consistency, which further supports the research hypothesis. The most convincing evidence in support of the critical role of intervening variables in decision making and adoption behaviour are the regressions, which explain about 73.2 to 93.6 percent of the variation in adoption as compared to the mere 6.0 to 32.9 percent of the independent variables. The explanation for this highly significant difference is that the intervening variables are probably the immediate and direct determinants of adoption behaviour and that the influence of intervening variables only becomes manifested in adoption behaviour via the intervening variables. This explains why the influence of independent variables is much smaller and more inconsistent than that of the intervening variables. The practical implications of these findings are that the emphasis in the analysis and understanding of adoption behaviour should be on the intervening variables. They lend themselves as so-called "forces of change" and thus represent the focus of extension endeavours, but also as criteria for evaluation and monitoring. From the study arise various issues that call for further research like refinement of the measurements.*

## TABLE OF CONTENTS

|   |              |
|---|--------------|
| <b>ABSTRACT.....</b>  | <b>II</b>    |
| <b>TABLE OF CONTENTS .....</b>  | <b>III</b>   |
| <b>LIST OF TABLES.....</b>  | <b>X</b>     |
| <b>LIST OF FIGURES .....</b>  | <b>XVI</b>   |
| <b>ABBREVIATIONS AND SYMBOLS .....</b>                                      | <b>XVIII</b> |
| <b>ACKNOWLEDGEMENTS .....</b>   | <b>XIX</b>   |
| <b>DEDICATION .....</b>   | <b>XX</b>    |
| <br>  |              |
| <b>CHAPTER 1 .....</b>  | <b>1</b>     |
| <b>INTRODUCTION .....</b>   | <b>1</b>     |
| <b>1.1 BACKGROUND TO THE STUDY.....</b>                                     | <b>1</b>     |
| <b>1.2 PROBLEM STATEMENT.....</b>   | <b>2</b>     |
| <b>1.3 OBJECTIVES OF THE STUDY .....</b>                                    | <b>2</b>     |
| <b>1.4 HYPOTHESES OF THE STUDY .....</b>                                    | <b>3</b>     |
| <b>1.5 SIGNIFICANCE OF THE STUDY.....</b>                                   | <b>5</b>     |
| <br>  |              |
| <b>CHAPTER 2 .....</b>  | <b>6</b>     |
| <b>LITERATURE REVIEW .....</b>  | <b>6</b>     |
| <b>2.1 MODELS OF BEHAVIOUR CHANGE.....</b>                                  | <b>6</b>     |
| <b>2.1.1 Traditional Approach .....</b>                                     | <b>7</b>     |
| <b>2.1.2 The 5-Stage or “Classical” adoption Process.....</b>               | <b>7</b>     |
| <b>2.1.3 The Campbell-Model .....</b>                                       | <b>8</b>     |
| <b>2.1.4 The Innovation - Decision Process Model .....</b>                  | <b>10</b>    |
| <b>2.1.5 The psychological field theory of Lewin.....</b>                   | <b>12</b>    |
| <b>2.1.6 The Tolman Model .....</b>   | <b>14</b>    |
| <b>2.1.7 The Theory of Reasoned Action (Ajzen and Fishbein , 1980).....</b> | <b>16</b>    |
| <b>2.1.8 Düvel's Model for Behaviour Analysis and change.....</b>           | <b>19</b>    |

|                          |   |           |
|--------------------------|---|-----------|
| <b>2.2</b>               | <b>THE STUDY CONCEPTUAL MODEL.....</b>  | <b>25</b> |
| <b>2.3</b>               | <b>EMPIRICAL STUDIES CONDUCTED IN THE AREA OF<br/>INDEPENDENT AND INTERVENING VARIABLES .....</b> | <b>26</b> |
| <b>2.3.1</b>             | <b>Independent variables and adoption .....</b>   | <b>26</b> |
| <b>2.3.1.1</b>           | <i>Age .....</i>  | <i>27</i> |
| <b>2.3.1.2</b>           | <i>Sex.....</i>   | <i>27</i> |
| <b>2.3.1.3</b>           | <i>Formal education .....</i>   | <i>27</i> |
| <b>2.3.1.4</b>           | <i>Farm size.....</i>   | <i>28</i> |
| <b>2.3.2</b>             | <b>Intervening variables .....</b>  | <b>28</b> |
| <b>2.3.2.1</b>           | <i>Need compatibility .....</i>   | <i>28</i> |
| <b>2.3.2.2</b>           | <i>Need Tension .....</i>   | <i>29</i> |
| <b>2.3.2.3</b>           | <i>Efficiency misperception .....</i>   | <i>29</i> |
| <b>2.3.2.4</b>           | <i>Awareness .....</i>  | <i>30</i> |
| <b>2.3.2.5</b>           | <i>Perception .....</i>   | <i>30</i> |
| <b>2.3.2.6</b>           | <i>Prominence .....</i>   | <i>30</i> |
| <br>                     |   |           |
| <b>CHAPTER 3.....</b>    |   | <b>32</b> |
| <b>METHODOLOGY .....</b> |   | <b>32</b> |
| <b>3.1</b>               | <b>INTRODUCTION.....</b>  | <b>32</b> |
| <b>3.2</b>               | <b>DESCRIPTION OF THE STUDY AREA .....</b>  | <b>32</b> |
| <b>3.2.1</b>             | <b>Reasons for choosing Njombe district. ....</b>   | <b>32</b> |
| <b>3.3</b>               | <b>THE POPULATION AND SAMPLING PROCEDURE .....</b>  | <b>33</b> |
| <b>3.4</b>               | <b>INSTRUMENTATION AND DATA COLLECTION.....</b>   | <b>33</b> |
| <b>3.5</b>               | <b>VARIABLES AND THEIR MEASUREMENT .....</b>  | <b>34</b> |
| <b>3.5.1</b>             | <b>Independent variables.....</b>   | <b>34</b> |
| <b>3.5.2</b>             | <b>Intervening variables .....</b>  | <b>35</b> |
| <b>3.5.3</b>             | <b>Dependent variables:.....</b>  | <b>39</b> |
| <b>3.6</b>               | <b>DATA ANALYSIS .....</b>  | <b>42</b> |

|   |           |
|---|-----------|
| <b>CHAPTER 4.....</b>   | <b>44</b> |
| <b>PRODUCTION EFFICIENCY AND ADOPTION OF<br/>RECOMMENDED MAIZE PRODUCTION PRACTICES .....</b>                         | <b>44</b> |
| <b>4.1 INTRODUCTION.....</b>  | <b>44</b> |
| <b>4.2 PRODUCTION EFFICIENCY .....</b>  | <b>44</b> |
| <b>4.3 ADOPTION OF RECOMMENDED MAIZE PRODUCTION<br/>PRACTICES.....</b>  | <b>45</b> |
| <b>4.3.1 Seed.....</b>  | <b>45</b> |
| <b>4.3.2 Fertilization.....</b>   | <b>48</b> |
| <b>4.3.2.1 Phosphate fertilizers .....</b>  | <b>48</b> |
| <b>4.3.2.2 Nitrogen fertilizers.....</b>  | <b>49</b> |
| <b>4.3.2.3 Time of nitrogen fertilizer application.....</b>   | <b>50</b> |
| <b>4.3.2.4 Fertilizer package .....</b>   | <b>52</b> |
| <b>4.3.3 Seed Spacing .....</b>   | <b>53</b> |
| <b>4.3.4 Weeding.....</b>   | <b>55</b> |
| <b>4.4 MAIZE PRODUCTION PACKAGE .....</b>   | <b>58</b> |
| <br>  |           |
| <b>CHAPTER 5.....</b>   | <b>61</b> |
| <b>THE INFLUENCE OF INDEPENDENT AND INTERVENING<br/>VARIABLES ON ADOPTION OF RECOMMENDED MAIZE<br/>VARIETIES.....</b> | <b>61</b> |
| <b>5.1 INTRODUCTION.....</b>  | <b>61</b> |
| <b>5.2 INDEPENDENT VARIABLES .....</b>  | <b>62</b> |
| <b>5.2.1 Age .....</b>  | <b>62</b> |
| <b>5.2.3 Formal education.....</b>  | <b>65</b> |
| <b>5.2.4 Farm size .....</b>  | <b>66</b> |
| <b>5.2.5 Area under maize .....</b>   | <b>67</b> |
| <b>5.2.6 Total influence of independent variables .....</b>   | <b>68</b> |
| <b>5.3 INTERVENING VARIABLES.....</b>   | <b>69</b> |
| <b>5.3.1 Efficiency misperception (EM) .....</b>  | <b>70</b> |

|  |  |           |
|--|--|-----------|
| 5.3.2  | Need tension (NT).....   | 71        |
| 5.3.3  | Need compatibility.....  | 72        |
| 5.3.4  | Awareness .....  | 73        |
| 5.3.5  | Prominence .....   | 74        |
| 5.3.6  | Perceived advantages and disadvantages of recommended maize varieties<br>..... | 75        |
| 5.3.6.1  | <i>Perceived advantages</i> .....  | 75        |
| 5.3.6.2  | <i>Perceived disadvantages</i> .....   | 77        |
| 5.3.7  | Total influence of intervening variables.....                                  | 83        |
| 5.4  | COMPARISONS BETWEEN INDEPENDENT AND INTERVENING<br>VARIABLES.....              | 84        |
| <br><b>CHAPTER 6.....</b>  |  | <b>86</b> |
| <b>THE INFLUENCE OF INDEPENDENT AND INTERVENING<br/>VARIABLES ON THE ADOPTION OF PHOSPHATE<br/>FERTILIZATION .....</b> |  | <b>86</b> |
| 6.1  | INTRODUCTION.....  | 86        |
| 6.2  | INDEPENDENT VARIABLES .....  | 86        |
| 6.2.1  | Age .....  | 86        |
| 6.2.2  | Sex.....   | 87        |
| 6.2.3  | Formal education.....  | 88        |
| 6.2.4  | Farm size .....  | 89        |
| 6.2.5  | Area under maize .....   | 90        |
| 6.2.6  | Total influence of independent variables .....                                 | 91        |
| 6.3  | INTERVENING VARIABLES .....  | 92        |
| 6.3.1  | Efficiency misperception (EM) .....  | 92        |
| 6.3.2  | Need tension (NT).....   | 94        |
| 6.3.3  | Awareness of solution.....   | 95        |
| 6.3.4  | Prominence .....   | 96        |
| 6.3.5  | Total influence of intervening variables.....                                  | 97        |

|   |   |            |
|---|---|------------|
| <b>6.4</b>  | <b>COMPARISONS BETWEEN INDEPENDENT AND INTERVENING VARIABLES.....</b> | <b>98</b>  |
| <br>  |   |            |
| <b>CHAPTER 7.....</b>   | <b>100</b>  |            |
| <b>THE INFLUENCE OF INDEPENDENT AND INTERVENING VARIABLES ON THE ADOPTION OF NITROGEN FERTILIZATION .....</b> | <b>100</b>  |            |
| <b>7.1</b>  | <b>INTRODUCTION.....</b>  | <b>100</b> |
| <b>7.2</b>  | <b>INDEPENDENT VARIABLES .....</b>                                    | <b>100</b> |
| <b>7.2.1</b>  | <b>Age .....</b>  | <b>101</b> |
| <b>7.2.2</b>  | <b>Sex.....</b>   | <b>103</b> |
| <b>7.2.3</b>  | <b>Formal education.....</b>  | <b>104</b> |
| <b>7.2.4</b>  | <b>Farm size .....</b>  | <b>106</b> |
| <b>7.2.5</b>  | <b>Area under maize .....</b>   | <b>108</b> |
| <b>7.6</b>  | <b>TOTAL INFLUENCE OF INDEPENDENT VARIABLES .....</b>                 | <b>109</b> |
| <b>7.3</b>  | <b>INTERVENING VARIABLES.....</b>                                     | <b>110</b> |
| <b>7.3.1</b>  | <b>Efficiency misperception (EM) .....</b>                            | <b>110</b> |
| <b>7.3.2</b>  | <b>NEED TENSION (NT).....</b>   | <b>113</b> |
| <b>7.3.3</b>  | <b>Awareness of solution.....</b>                                     | <b>114</b> |
| <b>7.3.4</b>  | <b>Prominence .....</b>   | <b>115</b> |
| <b>7.3.5</b>  | <b>Total influence of intervening variables.....</b>                  | <b>117</b> |
| <b>7.4</b>  | <b>COMPARISON BETWEEN INDEPENDENT AND INTERVENING VARIABLES.....</b>  | <b>118</b> |
| <br>  |   |            |
| <b>CHAPTER 8.....</b>   | <b>119</b>  |            |
| <b>THE ROLE OF INDEPENDENT AND INTERVENING VARIABLES ON THE ADOPTION OF THE TOTAL FERTILIZER PACKAGE</b>      | <b>119</b>  |            |
| <b>8.1</b>  | <b>INTRODUCTION .....</b>   | <b>119</b> |
| <b>8.2</b>  | <b>INDEPENDENT VARIABLES .....</b>                                    | <b>119</b> |

|  |   |                |
|--|---|----------------|
| 8.2.1  | Age .....   | 119            |
| 8.2.2  | Sex.....  | 121            |
| 8.2.3  | Formal education.....   | 122            |
| 8.2.4  | Farm size .....   | 123            |
| 8.2.5  | Area under maize .....  | 124            |
| 8.2.6  | Total influence of independent variables .....                            | 125            |
| 8.1  | <b>INTERVENING VARIABLES.....</b>   | <b>126</b>     |
| 8.3.1  | Efficiency misperception (EM) .....                                       | 126            |
| 8.3.2  | Need tension (NT).....  | 127            |
| 8.3.3  | Need compatibility.....   | 128            |
| 8.3.4  | Awareness .....   | 129            |
| 8.3.5  | Prominence .....  | 130            |
| 8.3.6  | Perceived advantages and disadvantages of fertilization .....             | 131            |
| 8.3.6.1  | <i>Perceived advantages</i> .....   | <i>131</i>     |
| 8.3.6.2  | <i>Perceived disadvantages</i> .....                                      | <i>133</i>     |
| 8.3.7  | Total influence of intervening variables.....                             | 136            |
| 8.4  | <b>COMPARISONS BETWEEN INDEPENDENT AND INTERVENING<br/>VARIABLES.....</b> | <b>137</b>     |
| <br><b>CHAPTER 9.....</b>  |   | <br><b>138</b> |
| <b>THE ROLE OF INDEPENDENT AND INTERVENING VARIABLES<br/>ON THE ADOPTION OF SEED SPACING .....</b> |   | <b>138</b>     |
| 9.1  | <b>INTRODUCTION.....</b>  | <b>138</b>     |
| 9.2  | <b>INDEPENDENT FACTORS.....</b>   | <b>138</b>     |
| 9.2.1  | Age .....   | 138            |
| 9.2.2  | Sex.....  | 139            |
| 9.2.3  | Formal education.....   | 140            |
| 9.2.4  | Farm size .....   | 141            |
| 9.2.5  | Area under maize .....  | 142            |
| 9.2.6  | Total influence of all independent variables.....                         | 143            |



|   |   |            |
|---|---|------------|
| <b>9.3</b>  | <b>INTERVENING VARIABLES.....</b>   | <b>143</b> |
| <b>9.3.1</b>  | <b>Efficiency misperception (EM) .....</b>                                | <b>143</b> |
| <b>9.3.2</b>  | <b>Need tension (NT).....</b>   | <b>145</b> |
| <b>9.3.3</b>  | <b>Awareness .....</b>  | <b>146</b> |
| <b>9.3.4</b>  | <b>Prominence .....</b>   | <b>147</b> |
| <b>9.3.5</b>  | <b>Total influence of intervening variables.....</b>                      | <b>148</b> |
| <b>9.4</b>  | <b>COMPARISONS BETWEEN INDEPENDENT AND INTERVENING<br/>VARIABLES.....</b> | <b>149</b> |
| <br><b>CHAPTER 10.....</b>                          |   | <b>150</b> |
| <b>SUMMARY, CONCLUSIONS AND RECOMMENDATIONS....</b> |   | <b>150</b> |
| <b>10.1</b>   | <b>SUMMARY AND CONCLUSIONS.....</b>                                       | <b>150</b> |
| <b>10.2</b>   | <b>RECOMMENDATIONS.....</b>   | <b>156</b> |
| <b>APPENDIX 1.....</b>                              |   | <b>159</b> |
| <b>REFERENCE LIST .....</b>                         |   | <b>191</b> |

## LIST OF TABLES

|                     |   |           |
|---------------------|---|-----------|
| <b>Table 4. 1:</b>  | <b>Distribution of the respondents according to their production efficiency as reflected in yield (bags per acre).....</b>                                | <b>45</b> |
| <b>Table 4. 2:</b>  | <b>Distribution of respondents according to maize seed adoption and production efficiency as reflected in yield (bags/acre).....</b>                      | <b>46</b> |
| <b>Table 4. 3:</b>  | <b>Distribution of respondents according to maize seeds adoption and production efficiency as reflected in yield (bags/acre).....</b>                     | <b>47</b> |
| <b>Table 4. 4:</b>  | <b>Distribution of respondents according to phosphate fertilizer adoption and production efficiency as reflected in yield (bags/acre) .....</b>           | <b>49</b> |
| <b>Table 4.5:</b>   | <b>Distribution of respondents according to nitrogen fertilizer adoption and production efficiency as reflected in yield (bags/acre) .....</b>            | <b>50</b> |
| <b>Table 4.6:</b>   | <b>Distribution of respondents according to time of nitrogen fertilizer application and production efficiency as reflected in yield (bags/acre) .....</b> | <b>51</b> |
| <b>Table 4.7:</b>   | <b>Distribution of respondents according to fertilizer package adoption and production efficiency as reflected in yield (bags/acre) .....</b>             | <b>52</b> |
| <b>Table 4. 8:</b>  | <b>Distribution of respondents according to seed spacing adoption and production efficiency as reflected in yield (bags/acre).....</b>                    | <b>54</b> |
| <b>Table 4.9:</b>   | <b>Distribution of respondents according to weed infestation and production efficiency as reflected in yield (bags/acre).....</b>                         | <b>55</b> |
| <b>Table 4.10:</b>  | <b>Distribution of respondents according to weeding frequency and production efficiency as reflected in yield (bags/acre).....</b>                        | <b>56</b> |
| <b>Table 4. 11:</b> | <b>Distribution of respondents according to weeding frequency, weed infestation and production efficiency as reflected in yield (bags/acre) .....</b>     | <b>57</b> |
| <b>Table 4.12:</b>  | <b>Relationship between maize production packages and production efficiency as reflected in yield (bags/acre) .....</b>                                   | <b>59</b> |

|                     |   |           |
|---------------------|---|-----------|
| <b>Table 5. 1:</b>  | <b>Distribution of the respondents according to their age .....</b>   | <b>62</b> |
| <b>Table 5. 2:</b>  | <b>Distribution of respondents according to their age and the adoption of maize varieties .....</b>   | <b>63</b> |
| <b>Table 5. 3:</b>  | <b>Distribution of respondents according to their sex and the adoption of maize varieties. ....</b>   | <b>64</b> |
| <b>Table 5. 4:</b>  | <b>Distribution of respondents according to their formal education and the adoption of maize varieties .....</b>  | <b>65</b> |
| <b>Table 5. 5:</b>  | <b>Distribution of respondents according to their farm size and the adoption of maize varieties.....</b>  | <b>67</b> |
| <b>Table 5. 6:</b>  | <b>Distribution of respondents according to their area under maize and the adoption of maize varieties .....</b>  | <b>68</b> |
| <b>Table 5. 7:</b>  | <b>Total influences of independent variables .....</b>  | <b>69</b> |
| <b>Table 5. 8:</b>  | <b>Relationship between EM and adoption of recommended maize varieties .....</b>  | <b>70</b> |
| <b>Table 5. 9:</b>  | <b>Relationship between Need Tension (NT) and adoption of recommended maize varieties.....</b>  | <b>72</b> |
| <b>Table 5. 10:</b> | <b>Relationship between Need compatibility (NC) and the adoption of maize varieties .....</b>   | <b>73</b> |
| <b>Table 5. 11:</b> | <b>Relationship between awareness and adoption of recommended maize varieties .....</b>   | <b>74</b> |
| <b>Table 5. 12:</b> | <b>Relationship between prominence and adoption of recommended maize varieties .....</b>  | <b>75</b> |
| <b>Table 5. 13:</b> | <b>Relationship between perceived advantages and adoption of recommended maize varieties.....</b>   | <b>76</b> |
| <b>Table 5. 14:</b> | <b>Relationship between perceived disadvantages and adoption of recommended maize varieties.....</b>  | <b>78</b> |
| <b>Table 5. 15:</b> | <b>Relationship between different categories of adoption and the total numbers and weightings of advantages and disadvantages of recommended maize varieties.....</b> | <b>80</b> |
| <b>Table 5. 16:</b> | <b>Linear regression analysis showing the relationship between intervening variables and adoption.....</b>  | <b>83</b> |

|                     |  |            |
|---------------------|--|------------|
| <b>Table 6. 1:</b>  | <b>Distribution of respondents according to their age and phosphate fertilization.....</b>   | <b>87</b>  |
| <b>Table 6. 2:</b>  | <b>Distribution of respondents according to their sex and phosphate fertilization.....</b>   | <b>88</b>  |
| <b>Table 6.3:</b>   | <b>Distribution of respondents according to their formal education and phosphate fertilization .....</b>                             | <b>89</b>  |
| <b>Table 6. 4:</b>  | <b>Distribution of respondents according their farm size and the adoption of recommended rate of phosphate fertilization .....</b>   | <b>90</b>  |
| <b>Table 6. 5:</b>  | <b>Distribution of respondents according to their area under maize and phosphate fertilization.....</b>                              | <b>91</b>  |
| <b>Table 6. 6:</b>  | <b>Total influences of independent variables .....</b>   | <b>92</b>  |
| <b>Table 6.7:</b>   | <b>Distribution of the respondents according to their efficiency misperception (EM) and phosphate fertilization .....</b>            | <b>93</b>  |
| <b>Table 6.8:</b>   | <b>Distribution of the respondents according to their need tension (NT) and phosphate fertilization.....</b>                         | <b>94</b>  |
| <b>Table 6.9:</b>   | <b>Distribution of the respondents according to their awareness and phosphate fertilization .....</b>                                | <b>95</b>  |
| <b>Table 6 10:</b>  | <b>Distribution of the respondents according to their prominence and phosphate fertilization .....</b>                               | <b>96</b>  |
| <b>Table 6. 11:</b> | <b>Linear regression analysis showing the relationship between intervening variables and adoption of phosphate fertilization....</b> | <b>97</b>  |
| <b>Table 7.1:</b>   | <b>Distribution of respondents according to their age and nitrogen fertilization.....</b>  | <b>101</b> |
| <b>Table 7.2:</b>   | <b>Distribution of respondents according to their sex and nitrogen fertilization.....</b>  | <b>103</b> |
| <b>Table 7.3:</b>   | <b>Distribution of respondents according to their formal education and nitrogen fertilization .....</b>                              | <b>105</b> |
| <b>Table 7.4</b>    | <b>Distribution of respondents according to their farm size and Nitrogen fertilization.....</b>                                      | <b>107</b> |

|                    |  |            |
|--------------------|--|------------|
| <b>Table 7. 5:</b> | <b>Distribution of respondents according to their area under maize and nitrogen fertilization .....</b>  | <b>109</b> |
| <b>Table 7.6:</b>  | <b>Regression analysis of the influences of independent variables on adoption of nitrogen fertilization.....</b>   | <b>110</b> |
| <b>Table 7.7:</b>  | <b>Distribution of respondents according to their efficiency misperception (EM) and nitrogen fertilization .....</b>                                     | <b>111</b> |
| <b>Table 7 8:</b>  | <b>Distribution of respondents according to their perceived need tension (NT) and Nitrogen fertilization.....</b>  | <b>113</b> |
| <b>Table 7 9:</b>  | <b>Distribution of respondents according to their awareness and Nitrogen fertilizer recommendations .....</b>  | <b>115</b> |
| <b>Table 7.10:</b> | <b>Distribution of respondents according to their perceived prominence of the recommended nitrogen fertilization and its adoption.....</b>               | <b>116</b> |
| <b>Table 7.11:</b> | <b>Influence of intervening variables on adoption of nitrogen fertilization .....</b>  | <b>117</b> |
| <b>Table 8.1:</b>  | <b>Distribution of the respondents according to their age and the adoption of fertilization (total fertilizer package).....</b>                          | <b>120</b> |
| <b>Table 8.2:</b>  | <b>Distribution of respondents according to their sex and the adoption of fertilization (total fertilizer package) .....</b>                             | <b>121</b> |
| <b>Table 8.3:</b>  | <b>Distribution of the respondents according to their formal education and the adoption of fertilization (total fertilizer package) .....</b>            | <b>122</b> |
| <b>Table 8.4:</b>  | <b>Distribution of respondents according to their farm size and the adoption of fertilization (total fertilizer package).....</b>                        | <b>123</b> |
| <b>Table 8.5:</b>  | <b>Distribution of respondents according to their area under maize and the adoption of fertilization (total fertilizer package) .....</b>                | <b>124</b> |
| <b>Table 8 6:</b>  | <b>Regression analysis of the influence of independent variables on the adoption of fertilization (total fertilizer package).....</b>                    | <b>125</b> |
| <b>Table 8.7:</b>  | <b>Distribution of the respondents according to the efficiency misperception (EM) and the adoption of fertilization (total fertilizer package) .....</b> | <b>126</b> |

|                     |  |            |
|---------------------|--|------------|
| <b>Table 8. 8:</b>  | <b>Relationship between Need Tension (NT) and the adoption of fertilization (total fertilizer package) .....</b>   | <b>127</b> |
| <b>Table 8. 9:</b>  | <b>Relationship between need compatibility (NC) and the adoption of fertilization (total fertilizer package) .....</b>   | <b>128</b> |
| <b>Table 8. 10:</b> | <b>Relationship between awareness and the adoption of fertilization (total fertilizer package) .....</b>   | <b>129</b> |
| <b>Table 8. 11:</b> | <b>Relationship between prominence and the adoption of fertilization (total fertilizer package) .....</b>  | <b>130</b> |
| <b>Table 8. 12:</b> | <b>Relationship between perceived advantages and the adoption of fertilization (total fertilizer package) .....</b>  | <b>132</b> |
| <b>Table 8. 13:</b> | <b>Relationship between perceived disadvantages and the adoption of fertilization (total fertilizer package) .....</b>   | <b>133</b> |
| <b>Table 8. 14:</b> | <b>Relationship between different categories of adoption and the total numbers and weightings of advantages and disadvantages of the fertilizer package.....</b> | <b>135</b> |
| <b>Table 8. 15:</b> | <b>Linear regression analysis showing the relationship between intervening variables and adoption.....</b>   | <b>136</b> |
| <br>                |  |            |
| <b>Table 9. 1:</b>  | <b>Distribution of respondents according to their age and their adoption of seed spacing.....</b>  | <b>139</b> |
| <b>Table 9. 2:</b>  | <b>Distribution of respondents according to their sex and the adoption of seed spacing .....</b>   | <b>139</b> |
| <b>Table 9. 3:</b>  | <b>Distribution of respondents according to their formal education and seed spacing .....</b>  | <b>140</b> |
| <b>Table 9. 4</b>   | <b>Distribution of respondents according to their farm size and the adoption of seed spacing.....</b>  | <b>141</b> |
| <b>Table 9.5:</b>   | <b>Distribution of respondents according to their area under maize and the adoption of seed spacing.....</b>   | <b>142</b> |
| <b>Table 9.6:</b>   | <b>Total influence of all independent variables on adoption of seed spacing.....</b>   | <b>143</b> |

|                    |   |            |
|--------------------|---|------------|
| <b>Table 9.7:</b>  | <b>Distribution of respondents according to their efficiency misperception (EM) and the adoption of seed spacing.....</b>                 | <b>144</b> |
| <b>Table 9 8:</b>  | <b>Distribution of respondents according to their Need tension (NT) and the adoption of seed spacing.....</b>                             | <b>145</b> |
| <b>Table 9.9:</b>  | <b>Distribution of respondents according to their awareness of the recommendation and their adoption of seed spacing .....</b>            | <b>146</b> |
| <b>Table 9.10:</b> | <b>Distribution of respondents according to their perceived prominence of the recommended seed spacing and their adoption of it.....</b>  | <b>147</b> |
| <b>Table 9.11:</b> | <b>Influence of intervening variables on adoption of seed spacing</b>   | <b>148</b> |
| <b>Table 10.1:</b> | <b>Comparative role of total independent and intervening variables in explaining the percentage variation in adoption behaviour .....</b> | <b>155</b> |

## LIST OF FIGURES

|                     |   |            |
|---------------------|---|------------|
| <b>Figure 2. 1:</b> | <b>A paradigm of Individual decision-making and adoption (Campbell, 1966) .....</b>   | <b>9</b>   |
| <b>Figure 2. 2:</b> | <b>A model of stages in the innovation-decision process (Rogers, 1983) .....</b>  | <b>11</b>  |
| <b>Figure 2. 3:</b> | <b>The Tolmans Model (Source: Tolman, 1951) .....</b>   | <b>15</b>  |
| <b>Figure 2. 4:</b> | <b>Factors determining a person's behaviour (Fishbein and Ajzen, 1975) .....</b>  | <b>17</b>  |
| <b>Figure 2. 5:</b> | <b>Indirect effects of external variables on behaviour (Ajzen and Fishbein, 1980).....</b>  | <b>18</b>  |
| <b>Figure 2. 6:</b> | <b>The relationship Between Behaviour determining variables in Agricultural Development (Düvel, 1991) .....</b>   | <b>20</b>  |
| <b>Figure 2. 7:</b> | <b>Framework for problem conceptualization as technique in identifying the relevant causal factors in a situation analysis (Source: Düvel, 1991) .....</b>                  | <b>21</b>  |
| <b>Figure 2. 8:</b> | <b>Diagrammatic illustration of problem magnitude or need tension as influenced by perception (Düvel, 1991).....</b>  | <b>23</b>  |
| <b>Figure 5. 1:</b> | <b>The mean numbers and weightings of advantages and disadvantages of recommended maize varieties as perceived by respondents in different categories of adoption .....</b> | <b>82</b>  |
| <b>Figure 5. 2:</b> | <b>Comparative contribution of independent and intervening variables on adoption behaviour.....</b>   | <b>85</b>  |
| <b>Figure 6.1:</b>  | <b>Comparative contribution of independent and intervening variables on adoption behaviour .....</b>  | <b>99</b>  |
| <b>Figure 7.1:</b>  | <b>Comparative contribution of independent and intervening variables on adoption behaviour .....</b>  | <b>118</b> |



**Figure 8. 1: Comparative contribution of independent and intervening variables on adoption behaviour in respect of fertilization..... 137**

**Figure 9.1: Comparative contribution of independent and intervening variables on adoption behaviour..... 149**

## ABBREVIATIONS AND SYMBOLS

|                |   |
|----------------|---|
| DALDO          | District agricultural and livestock development officer |
| H              | Hybrid  |
| UH             | Uyole hybrid  |
| P              | Pioneer hybrid  |
| TARO           | Tanzania agricultural research organization             |
| TSP            | Tri-super phosphate                                     |
| DAP            | Di-ammonium phosphate                                   |
| MRP            | Minjingu rock phosphate                                 |
| CAN            | Calcium ammonium nitrate                                |
| NPK            | Nitrogen Phosphate Potassium                            |
| FYM            | Farm yard manure  |
| FAO            | Food and agriculture organization                       |
| EM             | Efficiency misperception                                |
| NT             | Need tension  |
| NC             | Need compatibility                                      |
| n              | Number  |
| N              | Total number  |
| Kg             | Kilogram  |
| cm             | Centimeter  |
| %              | Percentage  |
| $\chi^2$       | Chi-square  |
| r              | Pearson's correlation                                   |
| p              | Probability   |
| df             | Degree of freedom                                       |
| R <sup>2</sup> | Regression coefficient                                  |

## ACKNOWLEDGEMENTS

My profound thanks go to the almighty God for enabling this work to reach at this stage. I wish to express my sincere and special thanks to my supervisor Prof. G. H. Düvel for his constructive criticism, comments and untiring guidance during the preparation and writing of this thesis.

I gratefully acknowledge FOCAL/PANTIL project for financing my PhD programme. I also wish to thank all staff members of District Council in Njombe District for helping me in the whole period of data collection. Special appreciations go to the District Agricultural and Livestock officer (DALDO), Ms Liana and her family for their moral, material and physical support during the entire course of data collection. I am highly indebted to village leaders and all interviewees for their cooperation in this research.

My Profound appreciation are extended to Ms Joe Courtze and Ms Suzan Mbilinyi for assisting in organizing the final version.

I want to take this opportunity to thank very much my mother Hulda Phillip for every kind of support she extended to me including taking care of my baby Elimina during her infant stage. Without her the completion of this work could have been of many difficulties. My Daughter Elimina has always been with me accompanying me in my studies and stay in South Africa.

I also thank my husband, sisters, brothers, other family members and friends for their love and support during the entire study. My daughters Elilumba and Elihaika are highly appreciated for not hesitating to stay away from me at their tender ages, but they have always been with me spiritually.

## **DEDICATION**

This work is dedicated to my precious mother, Hulda Phillip and my beloved brother Winston Phillip who laid the foundation of my education.