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Full Length Research Paper

Factors influencing adoption of stress-tolerant maize hybrid (WH 502) in western Kenya

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Non-adoption of suitable maize varieties was identified as the second most important constraint responsible for low maize yields in western Kenya. In order to increase adoption of suitable varieties it is important to know the factors that influence the choice of variety and adoption. This study aimed at identifying varietal, socio- economic and institutional factors that influence adoption of the maize hybrid, WH 502. Data were collected from a random sample of 504 households and 68 stockists from three districts of western Kenya. Results showed that the main attributes of WH 502 that influenced its adoption were high yield, early maturity and non-lodging, whereas the important socio-economic factors were farm size, cattle ownership, education level of the farmer and locality specific characteristics. The attributes of WH 502 that farmers disliked were poor storability and poor husk cover. Neighbors were found to play a more important role than the public extension service in making WH 502 variety known to farmers. Breeders need to improve on storability and husk cover attributes of WH 502 so as to sustain or improve adoption. Policy makers should support informal ways of extending new technologies to farmers and also support farmers through provision of adult education.

Key words: Hybrid maize, adoption, socio-economic characteristics, varietal characteristics, high yield, early maturity; storability.

INTRODUCTION

The majority of the households in Kenya are smallholders who live in the rural areas and depend on agriculture as their major economic activity. Maize is the major food staple for most of these households, and the main source of income and employment for the majority of rural households. Indeed, the maize plot is the center of economic activity for most smallholders in Kenya, with more than 70% of the maize area being cultivated by smallholder farmers (CBS, 1990).

In western Kenya, maize is the most important crop as well as the food staple. However, maize production has not kept up with the rate of population growth, leading to serious food insecurity (Hassan, 1998). Indeed, on ave-rage households in western Kenya are self-sufficient for only about six months in a year. Surveys carried out in the area (Salasya et al., 1998; Salasya, 2005) consistently report that maize yields are much lower than the expected yields based on research recommendations. For example, Salasya (2005) found that the annual maize yield in Vihiga District was less than 27% of the potential yield (1.80 tons/ha versus 6.67 tons per ha).

Maize yields are low mainly because households do not follow the recommended agronomic practices, particularly the use of soil nutrient replenishing technologies, the use of appropriate varieties, and other management practices. For example, Salasya et al. (1998) using household survey data found that local varieties gave significantly lower yields than improved varieties. The lack of, or non adoption of, suitable maize varieties was the second most important constraint responsible for low maize yields in the upper and lower midland zones (UM1 and 2, LM1 and 2) after low soil fertility (KARI, 1994). However, researchers in national and international institutions have developed several maize varieties (both hybrids and open pollinated varieties (OPVs)) suitable for farm households in the different regions and agro-ecological zones. One such hybrid is WH 502, which is high

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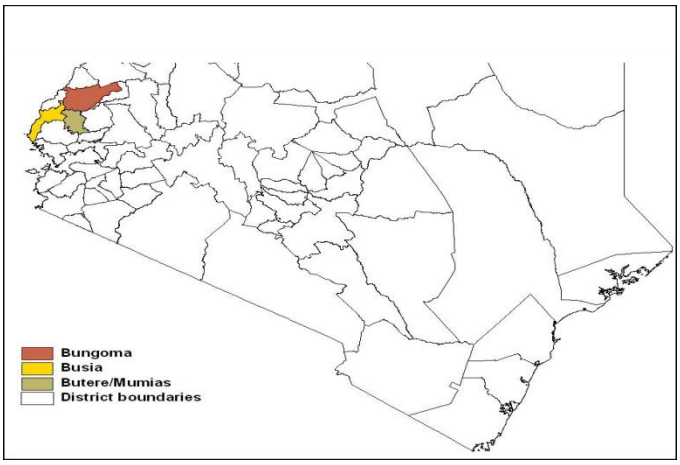

Figure 1. The study districts in western Kenya.

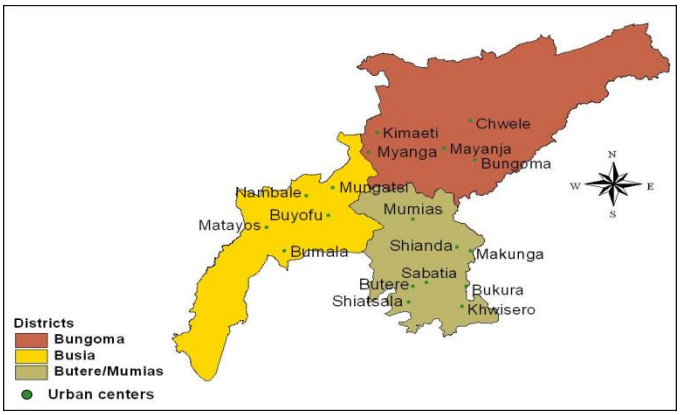

Figure 2. Main urban centers where input stockists are located.

yielding and matures early. In addition, it has an advantage over other hybrids in that it is the only hybrid in the market that is tolerant to maize streak virus and to *striga* weed.

Technology adoption by agricultural producers is an essential prerequisite for economic prosperity (Nkonya et al., 1997). A comprehensive understanding of the farmers' behaviour on adoption of technologies in diverse agro-ecological and socio-economic environments is therefore necessary to design appropriate strategies to harness potential benefits in the target areas (Shiyani et al., 2000). It is thus deemed important to understand the factors driving the adoption of WH 502 variety, which was released in 2002. Reports from the field were that it is very popular with the farmers in the upper and lower midland zones. Such information is important for breeders and other researchers when developing other varieties and when improving on the existing ones.

The specific objectives of the study were to: identify the attributes of WH 502 that influenced its adoption by farmers; identify the socio-economic and household factors that influenced the adoption of WH 502; and identify the local institutions that were key to its adoption.

METHODOLOGY

The study area

The study was conducted in three districts of western Kenya: Butere/Mumias, Busia and Bungoma (Figure 1). These districts were selected to cover the upper midland and the lower midland agro-ecological zones where the maize hybrid WH 502 is most suitable. The rainfall pattern in all the three districts is bimodal, allowing for two cropping seasons in a year. In Butere/Mumias the annual rainfall ranges between 1650 and 1850 mm, in Busia it ranges between 760 and 1790 mm, whereas in Bungoma it ranges between 1200 and 1800 mm. The long rains fall between March and June and the short rains between August and November (Jaetzold and Schmidt, 1983). Maize is the main food staple in all the three districts.

Butere-Mumias had a total population of 478,920 in 1999 with a population density of 525 persons per square kilometer (Republic of Kenya, 2001). The district is predominantly in the lower midland (LM1) agro-ecological zone with an average altitude of 1300 - 1500 m above sea level, (Jaetzold and Schmidt, 1983). The households have good access to markets for both inputs and outputs with varying transaction costs.

Busia, the second district has an estimated population of 391,913 persons (Republic of Kenya, 1997). It falls within the Lake Victoria basin, with altitude varying from 1130 m to 1375 m above sea level. All the lower midland agro-ecological zones (LM1 – 4) are found in the district, which means that the agricultural potential is quite diverse ranging from low potential in the LM4 to medium/high potential in LM1. Market access is fair with cross border trade with neighboring Uganda.

Bungoma, the third district had a total population of 1.03 m in 1999 with a population density of 515 persons per square kilometer (Republic of Kenya, 2001). The district is located mainly within the upper and lower midland zones including the lower midland one to three (LM1-3) and the upper midland one to four (UM1-4). The altitude ranges from 1200 – 1800 m above sea level (Jaetzold and Schmidt, 1983) . There is good market access with particularly a high number of input stockists compared to the other two districts.

Sampling procedures and data collection

Data were collected between November 2005 and March 2006. The districts in western Kenya which fall within the upper and the lower midland agro- ecological zones formed the sampling frame for districts. Simple random sampling was used to select the three districts, Butere/Mumias, Busia and Bungoma. A list of all the sub-locations in each district was then obtained and a simple random sampling was followed to select three sub-locations from each district forming a total of nine sub-locations. Two pairs of major land marks (permanent features such as a school, a church, a trading centre) in each of the selected sub-locations were randomly selected on a map and transect lines drawn joining each pair. Sampling was then done following as closely as possible the marked transects. A trained enumerator interviewed each fifth household, first on the left, then on the right, and back to the left using a formal pre-tested questionnaire. A total of 504 households from the nine sub-locations were interviewed. In addition 67 stockists were also interviewed. All survey locations were geo- referenced using global positioning system (GPS). Figure 2 shows the main urban centers where the stockists data were collected.

Table 1. Characteristics households look for in a maize variety.

Attribute	Frequency	Percent
High yielding	452	89.7
Early maturing	386	76.7
Good storability	305	60.5
Good grain texture/weight	228	45.2
Good grain size	227	45.0
Lodging characteristics	206	40.9
Drought tolerance	203	40.3
Disease resistance	198	39.3

Source: Survey data, 2006. Note: the responses are mutually exclusive, therefore they do not total to the number of respondents or the percentages to 100.

Analytical framework

Binary choice models also known as univariate dichotomous models are the most commonly used to analyze technology adoption decisions (Verbeek, 2003). These models essentially describe the probability that a technology will be adopted directly, although they are often derived from an underlying latent variable model. The common models that emerge are either the probit or the logit depending on the distribution function chosen for the stochastic term. In this study the probit model was chosen to analyze factors influencing farmers' decisions to adopt the WH 502. Following Verbeek (2003), the model is specified as:

$y_i^* = \boldsymbol{x_i}' \beta + \varepsilon_i$, $\varepsilon_i \sim \text{NID}(0,1)$

y_i^* is unobserved and is referred to as a latent variable. The assumption is that an individual farmer chooses to use a particular technology when the utility difference of using the technology and not using the technology exceeds a certain threshold, zero in this case, so that

$y_i = 1$ (uses the technology) if and only if $y_i^* > 0$

$y_i = 0$ if $y_i^* \leq 0$

The decision to adopt WH 502 is affected by the independent variables $\boldsymbol{x_i}'$ with the coefficients β. ε_i s are assumed to be independent of all $\boldsymbol{x_i}$. The independent variables ($\boldsymbol{x}_{1-18}$) hypothesized to influence the farmer's decision to adopt or not to adopt the variety are described in appendix I. The parameters are estimated by the maximum likelihood method.

RESULTS

Characteristics of farmers who had heard and those who had not heard of WH 502

Out of the 504 households interviewed, 441 (87.5%) had heard of the hybrid WH 502, whereas 63 (12.5%) had not. About 25% of those who had heard of WH 502 had access to extension service as compared to about half (that is, 12%) of those who had not heard of it. Slightly more than 50% (52.4%) of those who had heard of the variety were members of organizations compared with41.3% of those who had not heard. Those who had heard of WH 502 were more educated (7.6 years versus 6.6) and were younger (44.7 years versus 49.1 years) than those who had not heard. Farm size and the distance to the market were similar for both groups.

Results indicate that households plant two seasons in a year to maximize on the output, given the small land size. Indeed, 65.3% of the households pointed out that they plant maize twice in a year. Only 24.8% of the households interviewed had more than one maize field, with the rest having only one. If a variety takes too long to mature, it extends into the next season making it impossible to plant another crop, and that may reduce its adoption. The analysis that follows is based on the 441 households who had heard of WH 502.

Socio-economic characteristics of adopters and non-adopters of WH 502

Out of the 441 households who had heard of WH 502, 19.5% had grown the variety at least once (adopters), whereas 80.5% had never grown it (non-adopters). The adopters of WH 502 (Appendix II) were more educated, had larger farm size, larger area under maize, more cattle and larger area under permanent cash crops (both coffee and sugar cane) when compared to the non-adopters. Large farm size and maize area means that the farmer can try out a new technology on one part of the farm and still have room for the old technology on another. Households with a large area under cash crops on the other hand are able to use earnings from the cash crops to buy external inputs such as improved maize seed. Only 30.2% of adopters and 23.7% of non-adopters had contact with extension agents.

In addition, the higher percent of adopters came from male headed households, were engaged in full time farming, and had higher percentage of members who belonged to organizations. However, the percentage of those who had access to credit was slightly higher for non-adopters than for adopters.

Attributes preferred in a maize variety and those that influence adoption of WH 502

As shown in Table 1, high yield, early maturity and good storability were the three most important characteristics that households generally look for in a variety. In order of ranking, high yield was mentioned by almost 90% of the households, followed by early maturity (76.7%) and good storability (60.5%). Each of the other characteristics was mentioned by less than 50% of the households. For instance, disease resistance was mentioned by about 39% of the households. The attributes of WH 502 that influenced its adoption were similar to the general attributes considered when selecting a variety, particularly

Table 2. Farmers' sources of information about WH 502.

	Frequency	Percent
Neighbors	305	69.2
Radio	71	16.1
Stockists	39	8.84
Extension service	36	8.16
Western seed company staff	8	1.81
Others	16	3.62
Total	**441**	**100**

Source: Survey data, 2006.

high yield and early maturity. Out of the 28 households that considered WH 502 their best variety, all of them mentioned high yield and early maturity as characteristics that influenced its adoption. Other characteristics but less important were the good grain size, non-lodging and disease tolerance. Notably absent was *striga* tolerance, even though it is one of the main strengths of WH 502. This may imply that either the households who grew WH 502 did not have *striga* on their farms, and/or that during its promotion *striga* tolerance was not emphasized. The latter is supported by the fact that only 4.6% of the households were told that WH 502 was *striga* tolerant when its promotion was done.

The main attributes of WH 502 that households did not like were poor storability and poor husk cover as was mentioned by 78.2 and 31.5% of the respondents, respectively. It was reported that WH 502 maize grains could hardly stay in the store for three months and poor husk cover caused the maize to rot, especially if there was heavy rain at the time of harvest. It is necessary that if the variety is high yielding, it should have good storability. This is particularly so in places where maize is produced solely for food, and if for sale the grain is kept until the price is high. The other disadvantage was that its grains were light such that relatively more flour is required to make a certain amount of "Ugali" the staple meal prepared from maize.

Promotion of WH 502

Table 2 shows the various avenues through which farmers heard about the WH 502. Majority (69.2%) of the households heard about it from their neighbors but only about 8% heard of it from the government extension service. This is contrary to expectation as the government extension service is considered the main source of information for the farmers. This is due to the structural adjustment programs, which have led to staff retrenchment leading to a very high farmer to extension staff ratio. The shrinking public funding for agricultural extension has been noted elsewhere (Farrington, 1994). Another unexpected finding was that less than 2% of the sample heard of WH 502 from Western Seed Company which produced the variety. However, companies tend to leave the promotion part of the variety to the extension arm of the government as doing so themselves would increase the price of seed. In the case of WH 502 it is clear that the information came from neighbors. The increasing role of the radio in exposing new technologies to farmers was another notable finding. About 16% of farmers in the study got the information on WH 502 from the radio. In fact, data from a recent survey (unpublished, 2007) has shown that over 74% of households in western Kenya own a radio. The role of stockists as sources of information on WH 502 was small, as mentioned by less than 10% of the households. Apparently, other important sources such as demonstration plots and field days played an even more minor role as they were mentioned by less than 4% of households

Adoption time

Notably, the time between the farmers hearing about WH 502 and when this adoption study was carried out was fairly short. Some households did not have enough time to make a decision to adopt the variety. For example, over 52% of the households had heard about the hybrid in the year 2005 – which is also the year the survey started (Appendix III). If they had heard about this hybrid after planting, then by the time of the survey they had not had an opportunity to adopt the seed. It may be neces-sary to carry out another adoption study on the hybrid at a later stage. It was however important to do the survey at the time it was done because of the reports that the hybrid had become very popular within a very short time. It was necessary to capture the views of farmers at that time, on the characteristics of WH 502 that made it popular and the promotion strategies used. The informa-tion generated would be used to give feedback to breeders and policy makers.

None the less the adoption of WH 502 as reported in the current study follows the usual adoption process where a few innovators adopt the technology immediately, followed by the early majority, the late majority and finally the laggards. Moreover the adoption rates are comparable to those obtained by Ransom et al. (2003) in two of the provinces he investigated after a much longer period since the release of the varieties.

Factors influencing the adoption of WH 502 from the probit model

The results of the determinants of adoption of WH 502 from the probit model are shown in Appendix IV. The variables that significantly influenced the adoption of WH 502 were education of the farmer, distance to the market, number of cattle owned, number of maize seasons in a year and the district specific characteristics.

The result on distance to the nearest market was unexpected as it had a positive coefficient, implying that

the longer the distance from the household to the nearest market, the higher the probability of adopting WH 502. The expectation is that households located close to the market centre are more able to adopt a new technology because they have better access to stockists, and possibly incur less transaction costs. It may be that seed quality probably increased with distance.

Meanwhile households from Butere/Mumias District were more likely to adopt WH 502 than households in either Busia or Bungoma districts, possibly because the whole of Butere/Mumias District is located within the LM1, a zone most suitable for medium maturing hybrids such as the WH 502 varieties. Gender and age of the household head, access to extension service and credit, and membership to an organization, have the expected signs but do not significantly influence the decision to adopt WH 502, and similarly for coefficients on farm and household sizes.

DISCUSSION

Socio economic determinants of adoption

A large majority of small holders integrate food crop and cash crop production, although there have been differing views on their interaction. One view is that income generated from cash crops is used to purchase inputs necessary for food crop production (Jaeger, 1992; Karanja, 2002), or that cash crop producers have access to key inputs such as credit and training through cash crop schemes that are not available to non- participating households (Govereh and Jayne, 2003). The above view implies that households with a large area under cash crops are better placed to adopt technologies on food crops. The other view is that households with a large acreage under cash crops tend to concentrate on them and pay less attention to the food crops (Salasya, 2005; Strasberg et al., 1999). Apparently the former view is true for the households analyzed in this study as the adopters of WH 502 had a significantly higher area under cash crops (that is, sugarcane and coffee).

Similarly most farmers integrate livestock and crop farming. Sales of cattle products such as milk and hides provide cash that is used for purchase of inputs such as improved maize seed (Bebe, 2003), whereas cattle feed on crop by-products. Besides, cattle provide manure, which is an added incentive to plant an improved variety as it can substitute for fertilizer.

The role of education in the adoption of technologies has been demonstrated (De Groote et al., 2005).

Educated farmers have a better opportunity to acquire and process information on new technologies. The significance of the level of education on adoption thus emphasizes the importance of adult education and infor-mal training for the farming households. It also empha-sizes the importance of educating children, who form the future farming community.

A positive correlation between distance to the market and adoption of a technology has been obtained in other studies. Karugia (2003) found a positive correlation between distance to the market and adoption of hybrid seed and use of fertilizer on maize in central and western Kenya. Ayieko and Tschirley (2006) showed that farmers do not necessarily purchase inputs from the nearest stockists. Their study showed that the difference between where farmers purchase inputs and the nearest input seller are significant. Similarly, Nyoro et al. (2006) showed that whereas a stockist may be located near a farmer, the farmer could still travel longer distances to buy inputs if convinced he/she will make a cost saving. Distance may thus be proxying the quality of seeds bought at distant sources, or the reliability of supply.

Varietal attributes influencing adoption

The need to increase maize production cannot be over emphasized. Given the small farm sizes due to population pressure, increasing maize production means increaseing land productivity rather than area under maize. This makes yield an important attribute for any variety. Hence, although some studies belittle the importance of yield in the farmers choice of technology (Odendo et al., 2006), this study has shown that yield was in fact the most important attribute influencing adoption. Moreover, the importance of yield in the choice of maize varieties seems to cut across regions. In Honduras, Hintze et al. (2003) found that yield is the only characteristic that had a consistent and significant impact on the adoption of OPVs over traditional varieties.

Similarly, with the reducing farm sizes, farmers increasingly plant two seasons in a year, and moreover the same plot is used in both seasons. That is why early maturity is another important attribute to consider in variety development. If a variety takes too long to mature it extends into the next season making it impossible to plant another crop.

Promotion aspects of WH 502

Traditionally government extension agents have been the main source of new farming information/technologies. This role however seems to be diminishing with informal channels such as neighbors taking centre stage. Holloway et al. (2002) using a Bayesian spatial probit estimation found strong positive neighborhood effects with regard to the adoption of high yielding rice varieties in Bangaldesh. Indeed, individual networks have been demonstrated to be important sources of information sharing that affect adoption decisions (Bandiera and Rasul, 2002). Radio was also found to be playing an increasing role in exposing new technologies to farmers and that the majority of farmers in western Kenya own radios. Elsewhere radio has been found to be a cost-

effective way of reaching a large population of farmers (Garforth and Lawrence, 1997).

Conclusions and recommendations

Majority (88%) of the households interviewed had heard about WH 502, however, only 19.5% had grown the variety at least once. The first three most important attributes that households looked for in a variety were high yield, early maturity and good storability. Whereas WH 502 hybrid has the first two of these attributes (high yield and early maturity), it is very poor in storability. In addition it has poor husk cover that causes the maize to rot on the cob before harvest. There is need for breeders to improve on the storability and the husk cover attributes of WH 502 if its adoption has to increase and/or be sustained. The socio-economic factors that influenced adoption of WH 502 were education of the farmer, distance to market, farm size, number of cattle owned, number of maize seasons in a year and locality characteristics. Policy makers can support farmers through provision of adult education which should empower them to understand new agricultural technologies such as WH 502.

Informal sources of information, particularly neighbors were more important in making the WH 502 variety known to other farmers than the public extension service. Given the shrinking of public funding for agricultural extension, policy makers can support this informal way of extending messages about new agricultural technology by providing skilled facilitators. Radio can also be a cost-effective way of reaching a large population of farmers. Policy makers should increase the support for using radio to extend messages on new agricultural technologies.

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Appendix 1: The following independent variables were hypothesized to influence the farmer's decision to adopt or not to adopt a variety

(y_i) either positively (+) or negatively (-).

X_1 = *Level of education of the household head* (+)
This is the number of years spent in school and is a proxy for individuals' knowledge about new hybrids.

X_2 =*Age of the household head (+/-).* Older household heads have more experience in farming and so make better farming decisions. However, younger household heads may be more innovative and less risk averse.

X_3 =*Gender of the household head (+):* This is a dummy (1 = Male and 0 otherwise). Female-headed households are hypothesized to have fewer resources and less likely to have access to new information than male-headed households.

X_4 = *Household size (+):* Household size is indicative of the labor force available. More labor is required for an improved variety than for a local variety.

X_5 = *Farm size (+)*: It is the total land that a household had access to during the reference year. Farm size is a proxy for wealth.

X_6 =*Access to credit (+)* This is a dummy (1= yes and 0 otherwise) and indicates access to credit for purchase of maize production inputs. Households who have access to credit can relax their financial constraints and purchase improved seed.

X_7 = *Access to extension advice (+)* This is a dummy (1= yes and 0= no). Access to extension advice should result in households making better farming decisions, including that of adopting an improved variety.

X_8 = *Membership to an organization (+)* (1= is a member of an organization and 0 otherwise). Members of farmer organizations may have better access to information.

X_9 = *Distance to the market (-)* Farmers located close to markets incur less transaction cost, which lowers the ultimate cost of seed; so they are more likely to adopt.

X_{10} = *Livestock ownership (+)* It refers to the number of cattle owned by the household during the reference year. Sale of livestock products such as milk can provide cash that can be used to purchase inputs such as improved seed.

X_{11} =*Area under cash crop (=/-)* Cash crops generate income that households use to purchase inputs for other crops including improved maize seed. However, cash crops also compete for the available inputs, especially land and labor.

X_{12} = Number of maize seasons (+) This is a dummy where 1 = farmer plants one season a year and 2= farmer plants two seasons.

X_{13} =*District dummies:* These variables capture the role of spatial characteristics and socio-economic differences across regions in the adoption of improved varieties.

X_{14} = Marital status (+/-) (1 = married, 0= Otherwise)

X_{15} = Number of female adults (-)

X_{16} = distance to a tarmac road (-)

X_{17} = Main source of income (-). (1 = Farming 2 = off farm)

X_{18} = ***Hired labor (+):*** Household labor can be substituted or complemented with hired labor.

Appendix II. Socio-economic characteristics of adopters and non- adopters of WH 502.

Variable	Adopters (n=86)		Non-adopters (n=355)		Significance level of difference
	Mean	Standard deviation	Mean	Standard deviation	
Age of the farmer (years)	44.8	14.2	44.7	13.8	Not significant
Number of years in school	8.27	3.98	7.43	3.71	p=10%
Distance to the market (km)	3.77	3.40	2.98	2.79	p=5%
Distance to a tarmac road (km)	7.44	7.50	6.93	6.55	Not significant
Average maize acreage	1.34	1.34	1.00	0.84	p=1%
Size of the farm (acres)	4.75	8.98	3.43	3.57	p=5%
Number of cattle	3.07	3.87	1.96	2.08	p=1%
Area under cash crop (sugar cane)	1.20	4.48	0.67	1.37	p=10%
Area under cash crop (coffee)	0.1	0.44	0.03	0.14	p=5%
Gender of farmer (% male)	75.6		74.5		
Percent of farmers in fulltime farming)	69.8		63.9		
Access to credit (% yes)	3.50		3.90		
Access to extension (% yes))	30.2		23.6		
Membership of organization (% yes)	57.0		51.0		

Source: Survey data, 2006. **Note**: An adopter is defined as one who has grown WH 502 maize variety at least once on her/his farm and a non-adopter is one who has never grown the variety.

Appendix III. Year when households first heard about and first planted WH 502.

Year	First heard		First planted		
	Frequency	Percentage	Frequency	Percentage of adopters	Percentage of all farmers
2002	4	.9	3	3.5	0.07
2003	47	10.7	9	10.5	2.04
2004	157	35.6	16	18.6	3.63
2005	230	52.2	58	67.4	13.2
2006	3	.7			
Total	**441**	**100.0**	**86**	**100**	**19.5**

Source: Survey data, 2006.

Appendix IV. Probit estimation results of the factors affecting the choice of WH 502 in western Kenya.

Variable	Coefficient	Std. Error	Sign level
Constant	-3.06	1.17	0.0092
Education of the farmer in years of schooling	0.04	0.02	0.0729
Age of the farmer in years	-0.01	0.01	0.3965
Gender of the farmer (1= male)	0.12	0.20	0.5459
Household size	0.02	0.02	0.2067
Farm size (acres)	0.01	0.03	0.8435
Credit accessible (1 =yes)	0.24	0.42	0.5616
Extension accessible (1=yes)	0.01	0.17	0.9480
Membership to an organization (1= a member)	-0.12	0.15	0.4136
Distance to the market in kilometers	0.05	0.03	0.0803
Number of cattle	0.08	0.04	0.0222
Area under sugarcane (acres)	-0.01	0.06	0.8688
Number of maize seasons in a year	0.84	0.20	0.0000

Appendix IV. contd.

District dummy (1=Butere/Mumias, 0 = otherwise)	0.42	0.23	0.0664
District dummy (1=Busia. 0= otherwise)	-0.21	0.24	0.3864
Marital status (1 = married, 0 = otherwise)	-0.25	0.25	0.3197
Number of female adults	-0.11	0.11	0.3329
Distance to a tarmac road (kms)	0.01	0.01	0.3462
Main income source (1=off farm, 0= farming)	-0.08	0.16	0.6182
If labor is hired (1= hired)	-0.11	0.17	0.5062
McFadden R-squared	0.12		
n = 441			

Source: Estimation from the survey data, 2006.

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