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The Socio-economic and Institutional Determinants of Adoption of Improved Cowpea Varieties in Northern Burkina Faso

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Aims: The objective of this research is to study the socio-economic and institutional determinants to the adoption of improved cowpea varieties. Specifically, it aims to estimate the rate of adoption of improved cowpea varieties and to determine the factors influencing the decision to adopt it.
Study Design: A questionnaire survey was conducted in northern Burkina Faso to collect data on the determinants of adoption of improved varieties of cowpea.
Place and Duration of Study: The survey was conducted in four villages in two communes in northern Burkina Faso in April 2016 for a month between 01/04/2016 and 30 April 2016.
Methodology: This study was conducted in two rural communes in the northern of Burkina Faso. On both sites, the sampling of producers has been purposive, striving to keep farmers in various situations including head farmer's gender and age. Two villages were surveyed in each rural commune, or on the whole, four villages surveyed for both communes. An econometric model was used, it is a binary model, the probit model. On the whole, one hundred and seventy-seven (177) farms were surveyed. Data were collected using a questionnaire and analyzed using the SPSS and Stata software.

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Results: The results give a rate 70.06% of adoption of improved cowpea varieties. The econometric results showed that five variables have influenced the decision to adopt improved varieties of cowpea, including: age, training to use improved cowpea varieties, the number of small ruminants possessed, the practice of vegetable gardening and the use of pesticides. Only vegetable gardening negatively influences the adoption of improved varieties, while the other four variables positively influence the adoption of improved cowpea varieties.

Conclusion: The adoption of new improved varieties of cowpea by farmers requires a capacity building of producers on the technical itinerary of the crop which is an important source of food and income for the population of this area.

Keywords: Adoption; improved variety; cowpea; determinants; probit model; farmer.

1. INTRODUCTION

Cowpea is a major crop in sub-Saharan Africa [1]. Indeed, it accounts for nearly 95% of the world production. 80% of the African production was produced in West Africa. The largest producers of cowpea in Africa include Nigeria, Niger and Burkina Faso [1]. In Burkina Faso, the agricultural sector contributes for 35% to the Gross Domestic Product (GDP) and involves 82% of the working population. Cowpea is a leguminosae widely cultivated in Africa and particularly in Burkina Faso. Drought resistant, the plant is well adapted to the arid climate of the sub-Saharan Africa. Rich in protein, the seed is very useful for human consumption; the crop residues can also be used as fodder. In Burkina Faso, cowpea production for the 2014/2015 agricultural campaign is estimated at 562,729 tons nationally. The Northern Region alone produced 110,466 tons of cowpea, representing 19.63% of the national production and the Yatenga Province produced 53,210 tons as for the Northern Region, or 48.17% of the regional production. It is essentially a self-consumed food crop or produced for local markets. Yet, it is increasingly present in urban markets and starts to get exported. Indeed, between 2005 and 2015, income generated by the export of cowpeas increased from CFA F 2,614,410,332 in 2005 to CFA F 98,897,305,694(1 dollar US = 610 Fcfa); in order words, receipts from cowpea export have increased more than 37 times according to data released by the Agency for Export Promotion (APEX) [2]. The improving of agricultural productivity and incomes in rural area necessarily involves the adoption of technological innovations including improved cowpea varieties. This study is carried out to responds to this concern and built around the following research questions: What are the socio-economic and institutional factors that impact on the adoption of improved cowpea varieties? What is the rate of adoption of improved cowpea varieties? The objective of the study is to determine the socioeconomic and institutional factors pertaining to the adoption of the improved varieties of cowpea while the specific objectives include:

- Assess the rate of adoption of improved varieties of cowpea in these two communes
- Determine the socioeconomic and institutional factors pertaining to the adoption of the improved varieties of cowpea in these two communes.

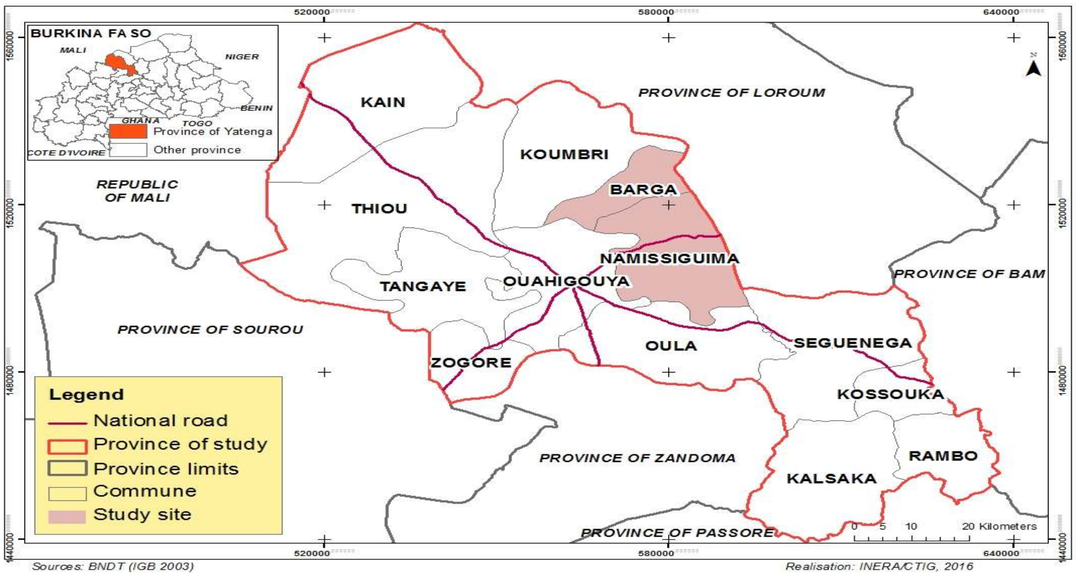
2. METHODOLOGY

2.1 The Study Area

The Yatenga Province is under a dry Sudano-Sahelian continental climate characterized by a dry season from November to April and a rainy season from May to October. The length of the season varies from one year to another. The Yatenga Province comprises thirteen (13) Communes including Barga and Namissiguima. According to the 2006 General Census of Population and Housing, the population of these two Communes is estimated at 65,223 inhabitants, including 52.48% of women. Nearly 48.82% is between 0-14 years. 46% of the population of both municipalities is between 15 and 64 years.

2.2 Data Collection and Analysis

This study was conducted in two Communes of the Yatenga Province. On both sites, the sampling of producers has been purposive, striving to keep farmers in various situations including head farmer's gender and age. The villages were chosen taking into account the



Map 1. Localization of the study sites

cowpea production, the accessibility of the village. Two villages were surveyed in each commune giving four villages on the whole of both communes. The producers were chosen taking into account the areas sown with cowpea and the gender. On each of the village sites, sampling of producers was carried out in a reasoned way, seeking to retain producers in various situations in terms of sex, age, size of the areas sown with cowpea. 44 producers were surveyed in each village except Tougou where there were 45. The villages include Lemnogo and Ramdolla for the Commune of Barga and Nogo and Tougou for the Commune of Namissiguima. 88 producers were surveyed at Barga and 89 at Namissiguima. On the whole, one hundred and seventy-seven (177) farms were surveyed. Data were collected using a questionnaire.

2.3 Theoritical Framework of Innovation and Dissemination

There are several definitions for innovations. Thus, agricultural innovation can be defined as the introduction of a new agricultural practice, sometimes, the improvement of a traditional practice [3]. Dissemination is the process by which an innovation is passed over to the members of a social system through some means of communication for a period of time [4]. The dissemination is based on four key elements including innovation, communication means, time and social system [5]. Five main factors determine the adoption and dissemination of a new technology, including: The relative advantage, the complexity, the compatibility, the testability and observation [3]. We think that the combination of these factors has more positive impact on the adoption of the technologies. The relative advantage of an innovation refers to the degree to which this latter is perceived as better than the existing ones [5]. The most important thing is to bring the farmer see this technology as being advantageous. Compatibility is the measure of the degree to which an innovation is perceived as consistent with existing values, past experiences, social practices and user standards [5,6]. This being, an idea that is incompatible with the current values and standards would take longer to be adopted than a compatible innovation. Testability is the possibility to test an innovation and change before starting using it. The opportunity to test an innovation will enable potential users to have more confidence in the product because they have got the opportunity to learn how to use it. Lastly, observability measures the degree to which the results and advantages of an innovation are obvious. Several studies have addressed the technology dissemination process in the agricultural sector by showing that initially, only a small number of producers adopt the innovation, and this technology is extended progressively [6,7]. Innovation can be defined as the practice or taking ownership of an invention by farmers [7]. Distribution is the development of the innovation from the source system to the receiving system [6]. Innovation is therefore an idea, a practice or subject seen as new by an individual, or other units. The innovation dissemination model states that a technology goes from its source to the end users through the agents [5]. The producer, who decides to use a new cowpea variety, makes this decision depending on the technical characteristics adopted and the state of the environment according to criteria specific to the producer. In fact, an innovation will be adopted when the farmers involved, given the information available, the interest or profit they can make from the technology because according to the traditional economic theory, the rationality of the individual is determined according to his own interest through the invisible hand [5,8].

The adoption of an innovation process is characterized as the acceptance, over time, of a specific item by individuals through specific transmission channels [9,10]. In our study, this focuses on an improved cowpea variety, adopted by a producer to adapt to climate change impacts. Several factors account for the adoption of improved varieties of cowpea.

2.3.1 Head farmer's age

This depends on how old is the farmer. Studies have shown that age impacts positively and negatively on the adoption of a new technology. We will consider the first case, i.e. age positively impacts on the adoption of improved varieties. In other words, the oldest farmers easily adopt the technologies. It is expected that age has a positive effect on the adoption of improved varieties of cowpea [11,12,13].

2.3.2 Level of education

This is a binary variable which may be 1 if the producer is at least literate and 0 if he is not. Theoretically, the level of education positively impacts on the adoption of the technology since it is expected that an educated farmer is more prone to adopt new technologies. This is a very key factor in technology adoption. This increases the level of understanding and the capacity to apply and disseminate instructions from technology dissemination services [14].

2.3.3 Training

Theoretically, training on the use of improved varieties improves productivity. Therefore, farmers who have received training are more likely to adopt improved varieties than those who have not. It is expected that training has a positive effect on the adoption of improved cowpea varieties. This is a binary variable. It is 1 if the producer is trained in the use of improved seeds of cowpea and 0 if he is not trained. It is often assumed that people who receive training on innovation generally tend to adopt it. We therefore expect a positive effect of this variable on the adoption of cowpea varieties. This hypothesis is confirmed by the results of other studies on the adoption [15].

2.3.4 Household size

This variable refers to the number of individuals in the household. Household size is often stated as a key variable in the adoption of new technologies [16,17,18]. Household size is a source of workforce. The household size is a variable that is positively linked to the adoption of new technologies. A large household is more prone to invest in improved seeds. A positive impact is expected from this variable.

2.3.5 The plot size

This variable is expressed in hectare. It is proven that the plot size is negatively correlated with the probability of adoption of improved varieties because the lager the field, the substantial the resources needed to purchase seeds. It is expected a negative impact from this variable [19,18].

2.3.6 Vegetable gardening

This is a binary variable. This is 1 if the farmer runs a vegetable gardening activity and 0 if not. It is expected that those who run vegetable gardening are more likely to adopt improved varieties since they have another source of income during the dry season of the year.

2.3.7 The number of small ruminants

Having small ruminants enables the household to produce manure to fertilize fields. A household with more small ruminants has another organic fertilizer compared to the one that has less. Yet, several studies have shown that using manure with improved seeds has a positive effect. Moreover, small ruminants are important sources of income for the producer. Farmers who have more small ruminants will be more willing to invest in the purchase of improved seeds than the others. It is expected that this variable positively influence the adoption of improved cowpea varieties [16].

2.3.8 The number of cattle

This concerns the number of cattle owned by the producer. According to [20], a larger livestock is also associated with a higher probability of adopting the technology. Indeed, the livestock is not only a wealth for the household, but also a workforce. A richer household is more motivated to adopt improved seeds of cowpea. It is therefore expected that this variable positively influence the adoption of improved cowpea varieties.

2.3.9 The use of chemical pesticides

This binary variable is 1 if the producer uses pesticides to treat his field of cowpea and 0 if not. Farmers using chemicals to fight against pests are more likely to adopt improved varieties of cowpea. Improved varieties are expected to be less sensitive to attacks by pests. Farmers using chemical pesticides can reduce their production costs by adopting these varieties [21].

2.3.10 Having a radio set

This binary variable is 1 if the producer has a radio set and 0 if not. It is expected that this variable positively impacts on the adoption of improved cowpea seed. We assume that the fact of having a radio set makes farmers open-minded, especially concerning innovations. A farmer with a radio set is more informed than the one who does not.

2.3.11 Experience cowpea farming

This is gives the number of years of cowpea farming as head farmer. It is expected that those who are more experience in cowpea farming as head farmer is most likely to adopt new cowpea varieties. The experience enabled the producer to have a substantial knowledge on this crop and enables him to easily choose resistant varieties. It therefore assumed that the number of years of experience in cowpea farming positively impacts the adoption of improved cowpea varieties [22,23]. The Table 1 explains the variables used in the model.

2.4 Econometric Modeling: Probit Model

The economic theory that supports the econometric models on adoption consists in maximizing utility. The theory of utility maximization is most often used to explain the producer's response to a new technology [24,21,5]. According to this theory, a new

Table 1. List of variables of the model and results expected from the parameters

Variables	Type of variables	Description	
Adoption	Qualitative	Varying Variable: 1 in case of adoption of improved variety of cowpea and 0 if not.	
Explanatory variables of the model			Result expected
Age	Quantitative	Head farmer's age	Positive
Level of Education	Qualitative	Level of education of the farmer : 1 educated, 0 non-educated	Positive
Training	Qualitative	Training on the use of improved varieties of cowpea. 1if yes, and 0 if no	Positive
Household size	Quantitative	Number of persons working in the farm	Positive
Plot size	Quantitative	Surface area of the cowpea plot	Negative
Vegetable gardening	Qualitative	Run vegetable gardening during the dry season. 1 if yes, and 0 if no	Positive
Number of small ruminants	Quantitative	Number of farmer's small ruminants	Positive
Number of cattle	Quantitative	Number of farmer's cattle	Positive
Use of pesticides	Qualitative	Use of pesticide. 1 if yes, and 0 if no	Positive
Having a radio set	Qualitative	Having a radio set. 1 if yes and 0 if no	Positive
Experience in cowpea farming	Quantitative	Number of years in cowpea farming as head farmer	Positive

improved variety will be adopted by the producer if the utility associated with the new improved cowpea variety is beyond that of the former variety (local variety). Several authors [24,25,26,27,5] have studied the adoption of agricultural innovations. The literature review of studies related to the adoption of innovations enables to identify three types of models commonly used to analyze the decision to adopt an agricultural technology: linear probability model, the Logit and the Probit. .As for Logit and Probit models, they are often used in most of the adoption studies. In this study, we will use econometric modeling with a probit model as an analysis tool because it was considered appropriate in the specification of the relationship between the probability of adoption and determinants thereof [27]. Indeed, it is assumed that the adoption of improved cowpea variety by farmers follows a normal law.

Economic theory that supports econometric models on adoption is maximizing utility. The theory of utility maximization is most often used to explain the producer's response to a new technology [24]. According to this theory, a new improved variety will be adopted by the producer if the utility associated with the new improved cowpea variety is higher than that of the former variety (local variety).Let's consider A_{ij}^{*} the utility that the farmer i places on the technical j with j = {0,1} showing that the cowpea variety has been adopted or not and i = {1,2,... ,n}. This utility can be represented by an unobserved latent variable which depends on the alternative choices and the producer's socio-economic, demographic and institutional characteristics. We have:

$$A_{ij}^{*} = X_i\beta + \varepsilon_i$$

Where β is a vector of unknown parameters and ε_i the random term distributed independently according to a normal law which average is 0 and the variance is 1.

A_{ij}^{*} may be interpreted as the expected utility associated with the adoption of improved cowpea varieties. The producer's decision is therefore a mutually exclusive two alternatives; he adopts or does not adopt the improved cowpea variety. Conventionally, we give 0 to one modality and 1 to the other. The associate variable is called the indicator or the observed (adoption or non-adoption):

A_{ij}= 1 if A_{ij}^{*}>0, adoption of improved cowpea varieties

A_{ij}= 0 if $A_{ij}^{*} \leq 0, non-$adoption of improved cowpea varieties

The adoption probability is therefore:

Pr [A_{ij} = 1] = Pr [A_{ij}^{*} > 0]

In a Probit model, we assume that the distribution function F is a normal reduced centered law N(0,1)

$$F(x) = \int_{-\infty}^{x} \frac{1}{\sqrt{2\pi}} e^{-t^2/2} dt$$

The specified probit model is the easy to use one on the econometric ground but limited in some cases where phenomena to analyze are more complex. Thus, the objective of this study is to identify the determinants to the adoption of improved cowpea seed; should we use a Probit function in which the decision to adopt a technology that is dichotomous and depend on the producer's characteristics (age, sex, educational level, in the area. In the Probit model, the coefficients of the explanatory variables are not directly interpretable, the sole information available is the sign of the parameters since it shows whether the associate variables influence the probability of the event y_i=1 upward or downward. Nevertheless, to measure the sensitivity of this probability to the explanatory variables, we use the marginal effects.

3. RESULTS AND DISCUSSION

3.1 Cowpea Farmers' Socioeconomic and Institutional Characteristics

3.1.1 Descriptive results of continuous variables

Farmers' socioeconomic characteristics farmers show that the average age (45.81) of farmers who have adopted the new cowpea varieties is higher than those who did not adopt improved varieties (41.94) as shown in the Table 2. Year gap is around 4 years between both groups. The average household size, i.e. the average number of persons in the farm of those who have adopted cowpea (13.21) is slightly higher than those who did not adopt (12.81) the varieties of cowpea. Large households are more likely to adopt improved varieties than the small ones. This means that large families have more workforce than the small ones. Also, it should be noted that large families have many mouths to feed, which explains the use of improved seeds to increase production. The average surface area of farmers who adopt improved cowpea varieties (0.43) is slightly higher than those who do not (0.37).The average number of small ruminants of farmers who adopt (8.49) improved varieties is almost triple than that of those who do not (3.13).This means that those who adopt the improved cowpea varieties are those with a large number of small ruminants (goats and cattle). The average number of cattle of those who adopt (1.77) improved varieties is also higher than those who do not (1.25). This means that farmers with more cattle are more likely to adopt improved varieties because they have much manure and income. The analysis also shows that farmers with more seniority in the cowpea farming as head farmer more likely to adopt improved varieties of cowpea because they have more experience as shown in Table 2.

3.1.2 Descriptive results of dummy variables

Table 3 shows that 73.30% of men adopt improved varieties of cowpea against 60.90% of women. Also, 73.50% of educated respondents use these varieties against 67% of uneducated. Concerning the use of these varieties by farmers who received training or not, nearly 87.20% of those who are trained use improved varieties of cowpea against 65.2% of those who did not receive any training.72% of respondents member to a farmers' association use it against only 68.6% of those who are not member to an association. 71.5% of those who have a radio set adopt the improved variety against 66% who do not have. On the contrary, vegetable growers use less improved varieties than non-vegetable growers; the rates of use is 65.3% against 71.90% respectively. However, having a radio set seems to be an advantage to the use of the improved variety.

3.2 Adoption Rate of Improved Varieties of Cowpea

The adoption rate is the percentage of the ratio between those who adopt cowpea and the whole user population. The adoption rate depends on several factors. In a sample of 177 respondents, 124 have adopted the improved cowpea varieties, or 70.06%. We note that the rate of adoption of improved varieties of cowpea is less

Table 2. Some Socioeconomic quantitative characteristics per status of adoption

Characteristics	Farmers having adopted the improved cowpea varieties			Farmers who did not adopt the improved cowpea varieties		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Age	45.81	21	75	41.94	20	65
Household size	13.21	3	44	12.81	2	35
Plot size	0.43	0.13	3.00	0.37	0.10	1.00
Number of small ruminants	8.49	0.00	200.00	3.13	0.00	17.00
Number of cattle	1.77	0	12	1.25	0	10
Number of years of experience in cowpea farming	18.73	1	55	17.85	0	40

Table 3. Some Socioeconomic qualitative characteristics of farmers per status of adoption

Socioeconomic qualitative characteristics		Famers having adopted improved cowpea varieties	Farmers who did not adopt improved cowpea varieties
Sex	Male (%)	73.30	26.70
	Female (%)	60.90	39.10
Level of education	Educated (%)	73.50	26.50
	Non-educated(%)	67	33
Training	Trained (%)	87.20	12.80
	Non-trained (%)	65.2	34.80
Member to a farmer association	Yes (%)	72	28
	No (%)	68.6	34.40
Vegetable gardening	Yes (%)	65.3	34.7
	No (%)	71.90	28.1
Having a radio set	Yes (%)	71.5	28.5
	No (%)	66	34
Use of pesticide	Yes (%)	80.90	19.1
	No (%)	66.20	33.80

than the rate found in Burkina Faso, which was 95% in 2002. [28]. This rate was obtained under various conditions due to the fact that the estimates were based on the results obtained by a regional project, “cowpea in Africa”, on the project experimental sites [28].

3.3 Factors Pertaining to the Adoption of Improved Varieties of Cowpea

3.3.1 The principle of the likelihood ratio test

The likelihood ratio test [29] consists of comparing the likelihoods of two nested models M_p and M_c . with M_p the model comprising p variables, with therefore p + 1 parameter to be estimated; M_c the constrained model contains variables with c <p. This is why we speak of a nested model because all the variables are found in c in the latter model. The test statistic can be written as:

$$LR = -2 \times ln\frac{L(M_p)}{L(M_c)}$$

Where $L(M)$ is the likelihood of the model. Under H0, the coefficients of the additional variables that are found in M_c all are zero, LR follows a law of χ^2 with $(p - c)$ degrees of freedom.

We obtain an LR chi2 (11) = 27.72 and a probability of χ^2 greater than 0.0036 which is less than 0.01. The null hypothesis is thus rejected. We conclude that at the 1% threshold, the model is well adjusted. The Table 4 shown that the variables like age, training in the use of improved varieties, number of small ruminants possessed, and pesticide use significantly impact on the adoption of improved cowpea varieties. Age positively impacts on the adoption of improved varieties at 5% threshold. That is to say that the older you are, the more one is likely to adopt improved varieties. The analysis of the marginal effects shows that the fact of being old entails an increase in the probability to adopt improved cowpea varieties of 0.012 point. This result was confirmed in 2002 in Nigeria. [20] Indeed, in Nigeria, the producer’s age positively impacts on the adoption of improved cowpea varieties at 5% threshold.

The training on the use of improved varieties positively affect the adoption of improved cowpea varieties at 5% threshold. The more you are trained in the use of improved cowpea varieties, the more you are prone to adopt it. The analysis of the marginal effects shows receiving training on the use of improved cowpea varieties increases the probability to adopt improved cowpea varieties of 0.189 points.

The running of a secondary activity such as vegetable gardening negatively impacts on the adoption of improved cowpea varieties at 10% threshold. This means it is more likely to find a vegetable grower who does not use improved cowpea varieties simply because this vegetable grower think that he is less vulnerable since his activities generate resources that do not require the use of improved varieties. The marginal effects show that running vegetable gardening decreases the probability of adopting improved varieties of cowpea by 0.151 points. These results are invalidated in Mali. Indeed, secondary activities positively influence the adoption of improved cowpea varieties at 5% threshold [28].

The number of small ruminants possessed by a farmer positively affects the adoption of improved varieties at 1% threshold. This means that the more you have small ruminants, the more you adopt the improved cowpea varieties. The analysis shows that the number of small ruminants owned increases the probability to adopt improved varieties by 0.019 points. The more the producer has small ruminants, the more he is likely to adopt the improved cowpea varieties. Small ruminants are significant at 1% [30,31], This result is not confirmed in Nigeria. Indeed, in Nigeria, this variable was not significant [26]. The positive coefficient is consistent with forecasts. The use of pesticides to grow cowpea positively affects the adoption of improved cowpea varieties at 5% threshold. The analysis of the marginal effects shows that the use of pesticides in cowpea production increases the probability to adopt improved cowpea varieties by 0.172 points. The variable pesticide use is positively correlated with the adoption of improved varieties. Indeed, it is significant at 5% threshold. This result is invalidated in Nigeria [26] where it was found that the use of pesticides negatively impacted on the adoption of improved cowpea varieties at 5% threshold. Constraints to cowpea production include among other pest attacks. Parasites are a major source of risk in cowpea production. To effectively fight against parasites, farmers often use pesticides. The positive result of this variable coefficient is consistent with the initial forecasts. The improvement of crop productivity is a vital challenge for populations for whom agriculture remains the main source of income.

3.3.2 Impact of significant variables on adoption

After the determination of the variables that affect the adoption of improved cowpea varieties, it is necessary to see to what extent a change in the value of each significant variable affects the probability of adoption. This impact was captured through the calculated marginal effects contained in Table 5. As a reminder, the significant variables in the adoption of improved cowpea varieties are age, training, market gardening, possession of small ruminants and use of pesticides. The calculation of the marginal effects shows that these variables are significant at the respective threshold of 5%, 1%, 10%, 1% and 5%. The marginal effects show that being aged increases the probability of adoption of improved cowpea varieties by 0.011 point to the 5% threshold. Being trained increases the probability of improved cowpea varieties adoption by 0.192 point at the 1% threshold. The practice of market gardening is an unfavorable factor in the adoption of improved varieties of cowpea. Practicing market gardening decreases the probability of adoption of improved cowpea varieties by 0.151 points at the 10% threshold. Having a large number of small ruminants (goats and bovines) increases the probability of improved varieties adoption by 0.019 points at the 1% threshold. Using pesticides increases the probability of improved cowpea varieties adoption by 0.177 points at the 5% threshold as shown in Table 5.

Table 4. Econometric results of the factors pertaining to the adoption of improved cowpea varieties of the probit model

Variables	Improved cowpea varieties			
	Coefficients	**Std. Err.**	**z**	**P>z**
Age	0.036	0.017	2.05	0.040**
Level of education	0.276	0.222	1.24	0.215
Training	0.729	0.341	2.14	0.033**
Family size	0.005	0.014	0.34	0.734
Plot size	-0.036	0.428	-0.08	0.934
Vegetable gardening	-0.456	0.268	-1.70	0.089*
Number of small ruminants	0.059	0.023	2.62	0.009***
Number of cattle	-0.075	0.057	-1.31	0.189
Having a radio set	-0.206	0.253	-0.82	0.415
Use of Pesticide	0.639	0.286	2.23	0.025**
Experience in cowpea farming	-0.022	0.015	-1.47	0.141
Constant	-0.994	0.550	-1.81	0.071
Probit regression	Number of obs = 177			
	Wald chi2(11) = 27.72			
	Prob > chi2 = 0.0036			
	Log pseudo likelihood = -92.27			
	Pseudo R2 = 0.1460			

**significant at 10%, **significant at 5% ***significant at 1%*
Sources: Results from estimates

Table 5. Marginal effect after probit

Marginal effects after probit y = Pr(cowpea) = (predict) = 0.758				
Variables	**Marginal effect after probit**			
	Marginal effect (dy/dx)	**Std. Err.**	**Z**	**P>z**
Age	0.011	0.005	2.08	0.038**
Level of education	0.085	0.068	1.25	0.210
Training	0.192	0.071	2.71	0.007***
Family size	0.001	0.004	0.34	0.735
Plot size	-0.011	0.134	-0.08	0.934
Vegetable gardening	-0.151	0.094	-1.61	0.098*
Number of small ruminants	0.019	0.007	2.81	0.005***
Number of cattle	-0.023	0.017	-1.35	0.177
Having a radio set	-0.062	0.073	-0.85	0.397
Use of Pesticide	0.177	0.069	2.56	0.010**
Experience in cowpea farming	-0.007	0.005	-1.49	0.136

**significant at 10%, **significant at 5% ***significant at 1%*
Sources: Results from estimates

4. CONCLUSION

Cowpea occupies an important place in the northern part of Burkina Faso faced with a significant degradation of natural resources and the effects of climate change. The objective of this study was to determine the socio-economic and institutional factors influencing the adoption of improved varieties of cowpea. The choice to adopt improved varieties of cowpea or not is influenced by some socio-economic and institutional factors. Variables identified as having a significant impact on the probability to adopt improved cowpea varieties include the age of the household head, the training received to use improved cowpea varieties, the number of small ruminants possessed and pesticide use. The various results obtained and the significant impacts on the socio-economic welfare of rural populations and their leading role in the attainment of food security, their integration into policies, and the reinforcement of actions aiming to promote improved varieties in general, and particularly to improve improved cowpea varieties seem therefore necessary to ensure sustainable food security. To increase the rate of adoption of improved varieties, efforts should be made to make improved seeds available and address the issue of cowpea conservation if we want to achieve a greater adoption rate. An emphasis should also be laid on the training of farmers to ensure an optimal use of improved varieties. Indeed, a misapplied technology can have negative impacts on the expected productivity and is a source of demotivation. If farmers are well trained in the technical use of varieties, there is no doubt that the productivities will increase and by doing so, the number of farmers who adopt it will increase a little bit. Efforts should be made in terms of inputs and specifically pesticides. Indeed, phytosanitary treatments enable to fight against any kind of parasites. Farmers should be sensitized to use phytosanitary treatments. Lastly, it should be promoted the acquisition of animals by farmers since this will enables them to produce manure to fertilize fields and generate income to purchase improved seeds. Producers need to have a solid knowledge of technical itinerary of improved seeds. Therefore this must be the focus of producer training. The study also showed that mostly producers using pesticides to treat crops adopt improved seeds. This means improved seeds perform well when phytosanitary treatments are respected. Producers who practice market gardening do not adopt improved varieties of cowpea because they have a sure source of income from market gardening. They say that growing improved varieties is too risky because they are often infested.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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