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Farmers' Preferred Genotype Traits and Socio-Economic Factors Influencing the Adoption of Improved Cowpea Varieties in South-Central Niger

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Abstract: Cowpea, *Vigna unguiculata* (L.) (Walpers, 1842), is an important legume for food and nutrition security, and income generation. Despite decade-long efforts to disseminate improved varieties, cowpea productivity remains low in Niger. This is due, in part, to the limited adoption of improved cowpea varieties among farmers. Increasing the adoption of improved cowpea varieties requires a better understanding of farmers' preferred genotype traits and socio-economic factors that influence their decision. We interviewed 634 farmers from the south-central regions (Maradi and Zinder) of Niger to assess factors that influence their decision to adopt improved cowpea varieties. The average age of the respondent was 41 years with 29 years of farming experience. Eight improved cowpea varieties were grown by these farmers with average adoption rates ranging from 3.3 to 38.0%. Genotype traits that influenced farmers' decision to adopt improved cowpea varieties included early maturing (86.9%), high yielding (73.9%), and high market value (50.5%). Socio-economic factors that significantly influenced adoption were age, gender, membership in a farmers' organization, and contact with the extension services. Adoption is constrained by the limited availability of cowpea varieties with farmers' preferred genotypes traits. Farmers' preferences for genotype traits must be considered in the early stages of breeding programs and the release of new varieties to increase adoption. Stakeholders involved in the cowpea value chain can use this information to improve cowpea adoption and productivity.

Keywords: cowpea productivity; improved varieties; dissemination; smallholder farmers

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1. Introduction

Cowpea, *Vigna unguiculata* (L.) is the most important legume grown in the semi-arid tropics and one of the world's major legumes consumed in West Africa [1,2]. It is adapted to the Sahelian climate which is characterized by low rainfall and poor soil fertility [3]. Worldwide, Niger is the second largest cowpea producer after Nigeria [4]. In terms of area and production, cowpea is the second most important crop after millet in Niger [5]. Cowpea plays a key role in food and nutrition security, animal feed (fodder), and a cash crop for smallholder farmers [6,7].

Cowpea production suffers from important abiotic and biotic constraints including pests, diseases, and the effects of climate change [8,9]. Breeding programs have developed cowpea varieties that are tolerant or resistant to these constraints [2,10]. Several cowpea varieties have been released to farmers in Niger including those developed for pests, diseases, and/or drought tolerance or resistance [11–13]. Many of these varieties were released to farmers through large-scale extension activities by various projects [11,14].

Despite crop improvement and dissemination of new varieties, cowpea productivity remains low in Niger. Poor cowpea productivity is due, in part, to the limited use of improved varieties among farmers [15,16]. Adoption of improved seed can be constrained by several factors including seed types (technologies), the lack of awareness of or information on the availability of seed, or risk mitigation by farmers [17]. Smallholder farmers may be hesitant to invest in improved seed because of risks associated with crop failure (e.g., drought, pests, or diseases). Understanding smallholder farmers' behavior particularly their perceived preferences for genotype traits may help increase the adoption of improved cowpea varieties.

Prior studies on the adoption of improved cowpea varieties in Niger have focused on (i) the effect of socio-economic factors on the adoption of improved cowpea or millet production technologies (e.g., improved genotypes, biopesticides, biological control) disseminated under different extension approaches (i.e., farmers' field schools or demonstration plots) in the Maradi and/or Zinder regions [13,18], and (iii) modeling farmers' decision to adopt and increase the use of improved cowpea varieties in the Zinder and Tillabery regions [19]. These studies looked at the adoption of improved cowpea varieties in general (without a specific focus on a particular genotype) or a limited number of varieties, and focused on project areas/effects of extension approaches that influence the adoption of improved cowpea varieties. There is a need to assess whether farmers' preferred genotype traits and socio-economic variables may influence their decision to adopt improved cowpea varieties regardless of interventions (i.e., project areas and extension approaches).

The objective of this study was to identify improved cowpea varieties grown, assess their level of uptake, and measure factors affecting the preference of genotypes among smallholder farmers in the regions of Maradi and Zinder. We hypothesize that farmers' preferred genotype traits (e.g., insect pest and disease resistance, high yield, precocity), in addition to socio-economic characteristics, can influence the adoption of improved cowpea varieties. The results will be useful to development partners interested in the dissemination of cowpea varieties to increase crop productivity and improve the income of smallholder farmers.

This study, unlike others in Niger [13,18], makes three major contributions: first, in addition to socioeconomic characteristics, this study takes into account genotype traits (e.g., early maturity, insect pest resistance, disease resistance, drought resistance, yield, fodder production, and market value) in assessing the adoption of improved cowpea varieties. Second, the study assesses smallholder farmers' preferred genotype traits which is critical in understanding gaps in the adoption of improved cowpea varieties. Third, the study focus is wider than all prior publications. It identifies factors that influence the adoption of improved cowpea varieties disseminated in both the Maradi and Zinder regions regardless of intervention approaches used by development partners (e.g., NGOs, government, or others).

2. Materials and Methods

2.1. Study Area

The study was implemented in the south-central agricultural zone of Niger; in the regions of Maradi and Zinder (Figure 1). This is a Sahelian zone with a rainfall of 300 to 600 mm per year. Rainfall is poorly distributed and characterized by episodes of drought [20]. The rainy season begins in June and ends in October. The soils are sandy and sandy clay and generally poor. Agriculture is the main economic activity with more than 80% of the active population. Millet, sorghum, cowpea, and peanuts are the main crops.

2.2. Data Collection

This survey was implemented in July 2020 by interviewing 634 farmers in four departments in the Maradi (Mayahi and Guidan Roumdji) and Zinder (Mirriah and Magaria) regions. The regions and departments were selected based on their importance in cowpea production (i.e., quantity). These two regions produced 42.0% of the total national cowpea production in 2020 [5]. Villages in each department were selected based on cowpea production (i.e., quantity) and accessibility (road conditions due to flooding and security challenges) by the enumerators. Fifteen villages were randomly selected per region based on a list provided by local extension agents. In each village, 15 to 25 representatives of households were randomly selected from a list of cowpea producers who were available in the village during the study. Villages and producers' names written on slips of paper were drawn from a basket until the desired number was reached. The research unit was a cowpea producer who resided in any of the selected villages.

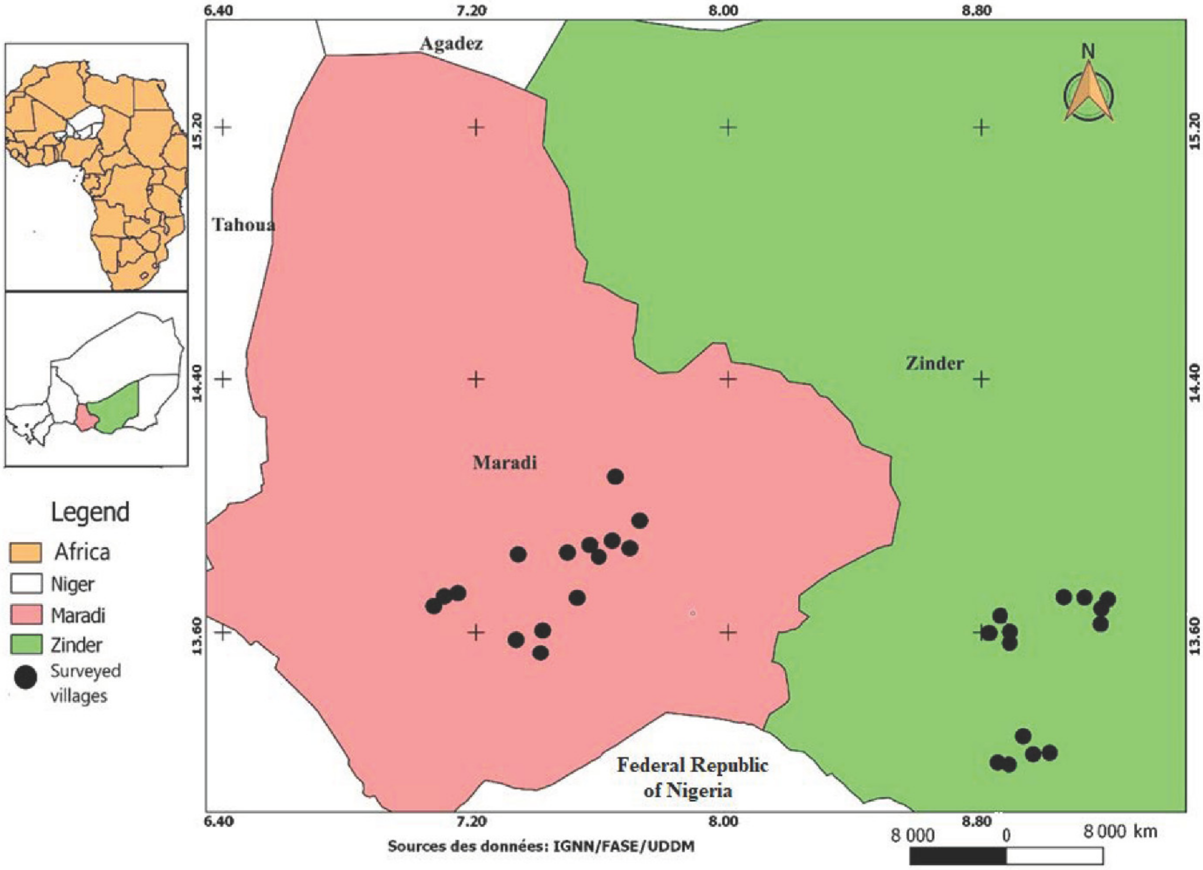

Figure 1. Map showing the area where the survey was conducted in both Maradi (left) and Zinder (right) regions, Niger. Each black dot represents a surveyed village.

Six enumerators were recruited and trained on how to implement the survey. For the identification of varieties, enumerators were trained on the characteristics of the 14 varieties registered in Niger. To facilitate the identification of improved cowpea varieties during the survey, we developed an illustration guide with pictures and packaged small samples of the 14 cowpea varieties registered in Niger. The illustration guide and the 14 samples of cowpea seed were given to each enumerator. The verification of the cowpea variety was carried out by cross-checking several pieces of information including the physical characteristics of the variety and also the visual observation of the seed sample by each respondent. In addition, producers brought their seeds to compare them with the samples provided to the enumerators. The shape, color, size, and appearance of the seed make it possible to distinguish cowpea varieties.

2.3. Empirical and Conceptual Models

The dependent variable "adoption" is dichotomous. It takes the value one (1) if the farmer adopts an improved cowpea variety, and zero (0), otherwise. The adoption of improved cowpea seeds is influenced by their genotype attributes and socioeconomic factors. Based on these attributes various factors (explanatory variables) are likely to influence the adoption of the technologies (Table 1). Several factors interact in an individual's decision whether or not to adopt a technology [21]. These are the socio-economic characteristics of the individual, the technology, the environment, and the institutional factors. Including farmers' perceptions of technology-specific attributes may help understand factors conditioning adoption choices [22].

Table 1. Description of variables used in the LOGIT regression model.

Variables	Description	Expected Effects
Dependent variables		
Adoption	1 if yes, 0 if no	
Explanatory variables		
Gender	1 for men, 0 for women	±
Ag	Age of respondents	±
Marital Status	1 married producer, 0 otherwise	±
Education level	1 if literate, 0 if not	+
Family size	Number of people in the household	
Member of farmers' group	1 if a member of a farmers' organization, 0 if not	+
Credit access	1 if access, 0 if not	+
Contact with extension	1 if received technical support from extension agent; 0 if not	+
Early maturity	1 if early maturing variety, 0 if not	±
Insect pest resistant	1 if variety is resistant to insect pests, 0 if not	±
Disease resistant	1 if a variety is disease resistant, 0 if not	+
Drought resistant	1 if a variety is drought resistant, 0 if not	+
High yield	1 if a variety has highly productive, 0 if not	+
Fodder production	1 if fodder variety, 0 if not	+
Market value	1 if a variety has good market value, 0 if not	+

The LOGIT model was used to assess the adoption of cowpea varieties [18]. In the literature, three types of models are mainly used to analyze the decision of producers to adopt an agricultural technology: linear probability models, LOGIT, and PROBIT. The first model has drawbacks because the probability can often exceed 1. The last two models are the most commonly used to specify the relationships between the probability of choice and the determining variables of choice. In the context of this study, a cowpea producer can adopt several improved varieties at the same time. However, we were interested to understand the adoption rate of each improved variety and the genotype traits and socio-economic factors that influence a farmer's decision. Thus, the binary logit model was considered more appropriate than the multinomial model. Unlike multinomial models where there are alternatives, here the choice is binary. LOGIT has the advantage of facilitating the interpretation of the β parameters associated with the explanatory variables X_i [23].

The decision to adopt an innovation only occurs when the combined effect of factors reaches a value from which the decision maker agrees to use or adopt an innovation. Considering the hypothesis that the effect is measured by an unobservable index I_d for the decision maker d and I_{0d} the critical value of the index from which he adopts the technology, two scenarios can arise:

If I_d is greater than or equal to I_{0d}, then he adopts the technology, and the adoption variable Y takes the value 1. The greater the index I_d is above the critical value, the higher the probability that the producer will adopt. If I_d is less than I_{0d}, it rejects the innovation and Y is equal to 0. This is presented in Equation (1).

$$\begin{cases} I_d \geq I_{0d} \Rightarrow Y = 1 \\ I_d < I_{0d} \Rightarrow Y = 0 \end{cases} \tag{1}$$

For individual d, the index I_d can be a linear combination of variables X_i that determine adoption and coefficients β_i to be estimated. Its expression is then mathematically given by: less than I_{0d}, it rejects the innovation and Y is equal to 0. This is presented in Equation (2).

$$I_d = \sum_{i=0}^{n} \beta_i X_{id} \tag{2}$$

With X_{id} the ith independent variable explaining the adoption of the technology by individual d and β_i its corresponding parameter to be estimated. The probability Pd for individual d to adopt the innovation is then (Equation (3)):

$$P_d = P\,(Y = 1) \tag{3}$$

As the index I_{0d} is a random variable, if we denote by F its function of cumulative probability or distribution function, it comes to (Equation (4)):

$$\begin{cases} P\,(Y = 1) = P\,(I_{0d} \leq I_d) = F\,(I_d) \\ P\,(Y = 0) = 1 - F\,(I_d) \end{cases} \tag{4}$$

The functional form of F is determined by that of the probability density function of the random variable I_d. For the logit model, it is a logistic function (Equation (5)):

$$F(X) = \frac{1}{1 + e^{-X}} = \frac{1}{1 + e^{-(\beta_0 + \beta_i Z)}} \tag{5}$$

2.4. Econometric Model

The empirical equation resulting from the model theory can be expressed as (Equation (6)):

$$P(Y_i) = \frac{1}{1 + e^{-X}} \tag{6}$$

with:

$$X = \beta_0 + \beta_1\, Gender + \beta_2 Age + \beta_3\, Marital\ status + \beta_4\, Education\ level + \beta_5\, Family\ size + \beta_6\, Member\ of\ farmers'\ group + \beta_7\, Credit\ access + \beta_8\, Contact\ with\ extension\ service + \beta_9\, Early\ maturity + \beta_{10}\, Insect\ pest\ resistant + \beta_{11}\, Disease\ resistant + \beta_{12}\, Drought\ resistant + \beta_{13}\, High\ yield + \beta_{14}\, Fodder\ production + \beta_{15}\, Market\ value + e_i$$

with:

where β_0 is the constant term; β_i the coefficients to be estimated and e_i error terms.

3. Results

3.1. Demographics and Other Characteristics of Respondents

The average age was about 41 years, 74% of respondents were men, 94% were married, and there were about five adults in each household (Table 2). Agriculture was the most important activity for all respondents, with an average experience of about 30 years. The average size of a field per respondent was 3 ha, and about half of it was used for cowpea production. A little less than half (45%) of the respondents had contact with the extension service and only 38.3% were members of farmers' organizations.

3.2. Adoption of Improved Cowpea Varieties

Adoption of improved cowpea varieties by region ranged from 3.3 to 38% (Table 3). Improved cowpea variety grown by the majority of farmers was IT90K 372-1-2 (38%) followed by UAM-09-1055-6 (11.4%). The use of local varieties by farmers was a little over three times higher in the Zinder than in the Maradi region. The adoption of improved varieties was comparable between the two regions, except for IT97K-499-35, which was higher in the Maradi region, and IT07K 292-10 (1), which was higher in the Zinder region.

Table 2. Socio-economic characteristics of respondents.

	Categorical Variables				
	Maradi	Zinder	Mean	χ^2	Prob
Men	78.1	69.9	74.0	5.44	**
Women	21.9	30.1	26.0	5.44	**
Married	92.8	94.9	93.9	1.26	ns
Credit access	4.7	4.7	4.7	0.001	ns
Extension contacts	43.6	46.8	45.2	0.68	ns
Member of a farmers' organization	40.1	36.4	38.3	0.93	0.33
	Continuous Variables				
	Maradi	Zinder	Mean	*t*-Test	
Age	48.1 ± 15.88	41.66 ± 14.33	41.15 ± 15.51	t = −5.79; p = 0.01	
Adults in the household	4.75 ± 4.58	5.83 ± 3.96	5.28 ± 4.31	t = −3.11; p = 0.9	
Years in agriculture	32.82 ± 14.99	25.79 ± 14.20	29.32 ± 15.01	t = −6.20; p = 0.14	
Years in cowpea production	27.19 ± 14.70	22.5 ± 13.05	24.86 ± 14.09	t = −4.39; p = 0.005	
Size of the farm (ha)	3.04 ± 2.76	3.25 ± 6.85	3.15 ± 5.21	t = −0.47; p = 0.03	
Area in cowpea production (ha)	1.46 ± 3.10	1.98 ± 4.43	1.72 ± 3.82	t = −1.70; p = 0.01	

**, ns: indicate significance at 5%, non-significant difference, respectively.

Table 3. Cowpea varieties adoption rates in Maradi and Zinder regions of Niger.

Cowpea Varieties	**Maradi**	**Zinder**	**Mean**	χ^2	**Prob**
Local varieties	27.3	84.5	55.7	210.69	***
IT90K 372-1-2	38.6	37.3	38.0	0.1	ns
UAM 09 1055-6	13.5	9.2	11.3	2.92	ns
IT07K 292-10 (1)	7.2	11.7	9.4	3.75	**
TN-121-80	10.7	7.9	9.3	1.42	ns
IT97K-499-35	8.5	4.1	6.3	5.08	**
KVX 30-309-6G	10.3	2.2	6.3	23.21	ns
IT99K 573-1-1	7.2	4.4	5.8	2.23	ns
IT99K 573-2-1	4.1	2.5	3.3	1.18	ns

***, **, ns: indicate significance at 1%, 5%, non-significant difference, respectively.

3.3. Factors Affecting the Adoption of Improved Cowpea Varieties

On average, most improved cowpea varieties were preferred by farmers due to early maturity (86.9%), high yield (73.9%), and high market value 50.5% (Table 4). Varietal attributes such as drought, disease, striga or witchweed (*S. gesnesrioides*), and insect pest resistance had low preferences among the respondents (Table 4). All genotype attributes were similar among all improved cowpea varieties except for high yield.

Socioeconomic characteristics such as contact with extension services and membership in a farmers' organization positively influenced the adoption of the UAM 09 1055-6 ($p < 0.01$) and KVX 30-309-6G ($p < 0.05$), respectively (Table 5). In addition, IT90K 372-1-2 ($p < 0.05$) was also influenced by contact with extension agents. Gender and age significantly influenced the adoption of IT97K-499-35 ($p < 0.05$) and IT99K 573-1-1 genotypes, respectively. For genotype traits, early maturity highly influenced the adoption of IT97K-499-35 ($p < 0.05$) and IT90K 372-1-2 ($p < 0.01$); while high yield strongly influenced the adoption of IT07K 292-10 ($p < 0.05$). Other genotype traits such as fodder production influenced the uptake of IT97K-499-35 ($p < 0.05$) and TN-121-80 ($p < 0.05$), while good market value only strongly influenced the adoption of TN-121-80 ($p < 0.05$).

Table 4. Smallholder farmers' (%) motivation to adopt improved cowpea varieties based on genotype traits.

	Cowpea Varieties										
Variety Attributes	**IT07K 292-10**	**IT90K 372-1-2**	**IT97K-499-35**	**IT99K 573-1-1**	**IT99K 573-2-1**	**KVX 30-309-6G**	**TN-121-80**	**UAM 09 1055-6**	**Average (%)**	χ^2	***p*-Value**
Early maturity (*n* = 499)	81.3	90.5	95.0	86.5	81.0	80.0	81.4	86.1	86.9	10.76	0.14
High yield (*n* = 424)	79.7	71.4	55.0	78.4	61.9	75.0	81.4	81.9	73.9	15.4	0.03
High market value (*n* = 290)	53.1	48.5	35.0	59.5	42.9	45.0	61.0	55.6	50.5	9.89	0.19
Fodder production (*n* = 216)	35.9	33.6	35.0	40.5	38.1	35.0	54.2	40.3	37.6	9.25	0.23
Drought resistant (*n* = 147)	28.1	27.4	15.0	16.2	28.6	15.0	25.4	33.3	25.6	9.40	0.22
Insect pest resistant (*n* = 70)	15.6	13.7	10.0	8.1	4.8	7.5	10.2	13.9	12.2	4.29	0.74
Disease resistant (*n* = 15)	1.6	1.7	0.0	5.4	0.0	5.0	3.4	5.6	2.6	7.39	0.38
Striga resistant (*n* = 5)	0.0	0.8	0.0	2.7	0.0	0.0	0.0	2.8	0.9	6.44	0.48

Table 5. Estimation model results on socioeconomics and genotype traits explaining the adoption of improved varieties.

	Cowpea Varieties							
	IT07K 292-10	**IT90K 372-1-2**	**IT97K-499-35**	**IT99K 573-1-1**	**IT99K 573-2-1**	**KVX 30-309-6G**	**TN-121-80**	**UAM 09 1055-6**
Gender	0.598	1.039	2.89 **	0.561	0.583	1.245	2.133	0.943
Age	1.001	0.995	0.987	1.041 **	0.994	1.000	0.992	1.015
Marital Status	1.314	0.666	2.710	0.583	1.297	1.361	1.712	0.868
Education level	0.945	0.89 **	0.956	0.858	1.211	0.805	1.031	0.905
Family size	1.012	1.020	1.037	1.027	1.016	0.952	1.053	0.965
Member of FO$^+$	0.816	0.889	0.725	0.903	0.517	2.794 **	0.300 **	0.684
Contact with extension	1.412	1.75 **	1.648	1.849	0.840	1.237	1.347	3.766 ***
Credit access	0.907	1.852	1.286	0.516	0.000	0.705	2.516	1.071
Early maturity	0.509 **	5.93 ***	6.76 **	0.928	1.010	0.639	0.476	0.927
High yield	2.842 **	0.49 **	0.42	2.022	0.741	2.478	2.226	2.078
Fodder production	0.791	0.918	2.72 **	1.129	1.620	1.299	2.426 **	1.002
High Market value	1.289	1.010	0.762	1.895	1.033	0.835	2.137 **	1.040
Drought resistant	0.993	1.206	0.746	0.402	1.574	0.372 **	0.927	1.634
Insect pest resistant	1.586	1.428	0.890	0.823	0.408	0.639	0.646	1.289
Disease resistant	0.382	0.440	0.000	1.413	0.000	2.048	0.486	1.669
Constant	0.094	0.672	0.004	0.014	0.030	0.054	0.020	0.037

***, ** indicates significance at 1%, 5%, respectively. $^+$ FO: Farmers' organization.

4. Discussion

The results show that eight improved varieties were cultivated by smallholder farmers in both regions. These improved cowpea varieties are among the 14 genotypes registered in the Nigerien crop catalog [24]. The IT90K 372-1-2 was the most widely used variety with an adoption rate of 38% across all regions. This genotype, which was disseminated in Niger about 25 years ago is still preferred and used by most smallholder farmers [11,14,19,25]. The adoption rate of IT90K 372-1-2 in this study is a little higher than the 30.5% [8] and much lower than the 61.5% [13] previously reported. The differences may be explained by the data collection methods. Rabe et al., (2017) surveyed participants in farmers' field schools who were trained on improved seed while Baoua et al., (2021) results are based on a broad sample of cowpea farmers. Overall, there has been significant progress in the adoption of IT90K 372-1-2 compared to 20 years ago; when uptake was at about 17% [11].

The level of adoption varied among varieties and between the two regions. Some of these varieties have been disseminated by development partners through projects in both regions [8,13,19]. Aside from IT90K 372-1-2, the remaining seven varieties had low uptake; with three genotypes (UAM 09 1055-6, IT07K 292-10 (1), TN-121-80) averaging around a 10% adoption rate. These four varieties have the following characteristics: medium maturity (70–75 days), drought resistant and yield of 1.5 tons/ha for IT90K 372-1-2; early maturity (55–60 days), drought tolerant and yield of 1.5 tons/ha for UAM 09 1055-6; early maturity (65–70 days), drought tolerant and yield of 2.5 tons/ha for IT07K 292-10 (1); and late maturity (75-80 days), drought susceptible and yield of 1.5 tons/ha for TN-121-80 [26]. It is interesting to note that early maturity influenced the adoption of IT90K 372-1-2 but not of UAM 09 1055-6. This might be because UAM 09 1055-6 is relatively a new variety (registered in Nigeria in 2016) that is not yet very popular among farmers in Niger [8,27].

Several socio-economic factors were found to explain differences in the adoption of improved cowpea varieties. In addition to the genotype trait (early maturity), contact with extension appeared to explain the high uptake of IT90K 372-1-2. Observed differences in adoption rates among varieties may be explained by the approaches used to disseminate improved cowpea varieties. For instance, some projects targeted different socioeconomic strata (e.g., gender, villages, and farmers' organizations) and included public extension services while others did not. The role of extension in increasing the adoption of improved seed has been demonstrated [15,17,19]. A study in the Zinder region linked the low use of improved genotypes to inadequate communication, unavailability, and high cost of cowpea seed [28]. Disseminating farmers' preferred genotypes using various extension approaches and targeting different socio-economic groups may help to accelerate the adoption of improved cowpea varieties.

The fact that IT90K 372-1-2 was the most adopted improved cowpea variety may be explained by its precocity (60–70 days) as well as large-scale dissemination [11,13]. The IT90K 372-1-2 is also known to have yields that are higher or comparable to those of other existing improved cowpea varieties [8,19]. In addition, the higher uptake of the IT90K 372-1-2 variety can be explained by the availability of its seeds. Seed availability plays an important role in technology adoption [17,29]. About 71.5% and 17.3% of all certified cowpea seed stocks in both regions were made of IT90K 372-1-2 and the three remaining genotypes (UAM 09 1055-6, IT07K 292-10 (1), TN-121-80), respectively [30]. Limited access (availability) to and low demand (preference) for these three improved genotypes (UAM 09 1055-6, IT07K 292-10 (1), TN-121-80) may explain the low adoption rate among farmers.

Though drought resistance did not influence farmers' adoption of IT90K 372-1-2, this variety is known to have this attribute [26]. Farmers in arid areas such as the Maradi and Zinder regions prefer varieties with multiple attributes that fit their production systems [19]. Drought-resistant or tolerant short-cycle varieties with good yields will help farmers cope with the negative effects of climate change [6,10,31]. Risk exposures are an integral part of farmers' decision-making to invest in agricultural inputs (e.g., fertilizer, seed) to increase crop productivity [32]. Hence, breeding programs must consider farmers' preferred attributes in the early stage of genotype development and release to increase the potential for adoption. Omitting farmers' perceptions of technology-specific attributes would negatively influence their adoption decisions [22,33].

5. Conclusions

This study found that farmers in the Maradi and Zinder regions of Niger grew eight improved cowpea genotypes. IT90K 372-1-2, though introduced 25 years ago, was the most widely used and highest-performing variety compared to recently released genotypes. Early maturity was the most significant factor that explained the adoption of IT90K 372-1-2, followed by contact with extension agents. Beyond these genotype traits, the high use of IT90K 372-1-2 was also due to the availability of seeds. Observed adoption gaps among varieties can be explained, in part, by the scarcity of cowpea seeds with farmers' preferred genotypes traits. To scale up the adoption of improved cowpea varieties, there is a need to (i) include farmers' preferred genotype traits in the early stages of breeding programs and seed release; and (ii) improve the availability of high-performing (early maturing with good yields) cowpea genotypes; and (iii) increase awareness and training using various extension approaches. Given the geographic limitations of our study (focused on two out of seven regions that produce cowpea in Niger) and, lack of information on the quality and how farmers access seeds, we propose that future research efforts (i) conduct the same study in other regions to validate our findings; (ii) assess the best approach to improve access and increase the availability of farmers' preferred genotypes, (iii) evaluate genotype purity to improve the quality of seed being supplied to farmers.

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