



RESEARCH ARTICLE

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EVALUATION OF THE AGRICULTURAL MECHANIZATION OF COTTON GROWERS IN THE SOUTH SUDANESE ZONE OF BURKINA FASO

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ABSTRACT

In the search for diversification of income sources and in order to reduce their tasks, producers have adopted agricultural mechanization in cotton production in the western cotton zone. Despite the growing interest of producers for this crop, few results exist on agricultural mechanization as practiced by producers in order to sustain the activity. The present study aims to know the agricultural production equipment in order to ensure the sustainability of the production systems in Burkina Faso. For this purpose, surveys have been carried out on farms of 90 farmers to contribute to a better knowledge of agricultural production equipment. The results of our work have shown that agricultural equipment varies according to the financial availability and the knowledge that the producer has of the crop. Agricultural equipment is adopted and used by producers in cotton growing. The use of these agricultural equipment depends on the activities on the cotton farms. The integration between these two fields of activity is perceptible on the sites of Tondogosso, Baré, Kari, Dohoun, Guéna and Sidi. Thus, 100% of well-equipped farm households use animal traction in soil preparation, crop maintenance and transport operations. On the other hand, no producer (0%) owns a mechanical seeder. The sustainability of the culture requires the establishment of an adequate system of supervision on culture, access to agricultural mechanization and equipment typical for cotton farming. Further studies are needed to provide accessible and inexpensive agricultural technologies to cotton growers.

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INTRODUCTION

The South-Sudanian zone of Burkina Faso, is the ultimate zone of cotton production. The main cash crop, cotton remains a major source of foreign exchange for Burkina. In fact, cotton represents 18% of total export earnings (INSD, 2014). This culture provides livelihood for about 20% of the labor force, accounting for 3.5% of GDP (IMF, 2014) and contributes to the mechanization of farms; hence its importance in the socio-economic balance of the country. However, in recent years, cotton growing has been facing profitability problems due to a recurring fall in yields partly due to inadequate farming practices (Pouya et al., 2013). Indeed, the current cropping systems face a low use of adequate agricultural equipment considered too expensive (Traoré et al., 2007a), a strong land pressure, There is also the monoculture which degrades the production of cotton (Traoré et al., 2007b). Despite the many supports that cotton has benefited from research, yields remain well below the potential of cultivated varieties. Despite this fervor for growing cotton, very little scientific information

exists on the level of agricultural equipment of cotton growers in Burkina Faso. In addition, the contribution of agricultural mechanization to cotton production is very little discussed, leaving doubts about the sustainability of cotton growing. At the current knowledge stage, the next research question remains unanswered. What is the level of agricultural equipment of cotton growers in the southern Sudanian zone of Burkina Faso? The overall objective of this study is to contribute to a better knowledge of agricultural production equipment in order to ensure the sustainability of production systems in the southern Sudanian zone of Burkina Faso.

MATERIAL AND METHODS

Presentation of the study area: Our study was conducted in the South-Sudanian zone of Burkina Faso in the *Hauts-Bassins* region. It covered 06 villages located in 03 provinces and 01 administrative region namely Houet, Kénédougou and Tuy. Survey sites were selected following a southwestern transect taking into account the experience of producers in cotton

growing. The investigations were carried out in the localities of Tondogosso and Baré (Houet), Dohoun and Kari (Tuy), Guéna and Sidi (Kéné Dougou). The cotton zone of western Burkina Faso is located between latitude 9 ° 3 South and 14 ° North (Ouédraogo, 2016). The area receives annual rainfall ranging from 900 to 1200 mm, with a rainy season lasting from 5 to 6 months. The climate of the site is of the South Sudanian type with annual mean temperatures ranging between 27 and 28 ° C (MECV, 2006). The vegetation cover is a mixed woody and grassy formation including savannas and clear forests. The soils are mostly tropical ferruginous (BUNASOLS, 2002).

The averages of the treatments were separated by the Newman-Keuls test at the 5% significance level.

RESULTS AND DISCUSSION

Results

Agricultural equipment: Table II presents the situation on equipment. From our surveys, regardless of the cotton production site (Baré, Tondogosso, Dohoun, Kari, Guéna and Sidi), it appears that 100% of producers own cattle.

Table 1. Agricultural equipment

Types of Equipment	Proportion of Producers per Agricultural Production Site (%)					
	Baré	Tondogosso	Dohoun	Kari	Guéna	Sidi
Plows	100	100	100	100	100	100
Carts	100	100	100	100	100	100
Weeders	100	100	100	100	100	100
Tractor	-	-	-	-	-	-
Hillers	100	100	100	100	100	100
Draft beef	100	100	100	100	100	100
Sprayer	100	100	100	100	100	100

Table 2. Types of animals

Animal types	Proportion of producers per farm production site (%)					
	Baré	Tondogosso	Dohoun	Kari	Guéna	Sidi
Bovine	100	100	100	100	100	100
Sheep	75	25	87,5	37,5	75	25
Goats	87,5	25	87,5	37,5	87,5	25
Equines (donkeys)	100	37,5	25	-	-	25
Pigs	75	-	-	-	-	25
Poultry	87,5	75	75	37,5	87,5	25

Methodology

Producers' perception of agricultural equipment for cotton cultivation was collected through opinion polls conducted at the farm level in six sites in the south-Sudanese zone of Burkina Faso, between June and December 2018. For this study, both sexes were concerned. A sample of 30 producers was selected per site, making a total of 180 producers for the six sites. The average age of producers was between 41 and 60 years old. The database used for the selection of holdings was obtained with the producer groups in the cotton zone. The selection of the producers to be surveyed was done in collaboration with the producer groups. This choice took into account three (03) criteria: (i) the cotton growing system, (ii) the types of agricultural equipment, and (iii) the method of acquisition of agricultural equipment. A semi-structured questionnaire was administered to the selected farms. The questionnaire was previously tested with 5 producers in the village of Tondogosso before its administration to the entire sample. The main aspects covered in this questionnaire focused on the farmer's knowledge of cotton production, the mode of acquisition of agricultural equipment, and the type of agricultural equipment. The survey was conducted in two stages: an interview with all members of the farm under the direction of the farm manager and a field visit on the cotton plot.

Data analysis

The collected data were stripped and then entered into the Excel software. Statistical analyzes were performed using the SPSS 12 Fr software and the XLSTAT version 2007 software.

At the Dohoun site, 87.5% of producers own sheep, followed by Baré and Guéna sites with 75% of producers owning sheep. The Kari site comes with 37.5% of producers. A quarter or 25% of producers have sheep in the Tondogosso and Sidi sites. With regard to goats, the producers of Baré, Dohoun and Guéna take the lead with 87.5%. On the other hand, in the village of Kari, there are 37.5 producers and 25% for Tondogosso and Sidi. It should be noted that 100% of Baré producers have equines followed by Tondogosso producers with 37.5% and 25% of producers at the Dohoun and Sidi sites. No producer of the Kari and Guéna sites owns an equine. Only 75% of Baré producers and 25% of Sidi have pigs. Finally, 87.5% of producers who own poultry are nationals of the villages of Baré and Guéna, followed by Tondogosso and Dohoun with 75% of producers, 37.5% in Kari and 25% in Sidi.

Animal equipment

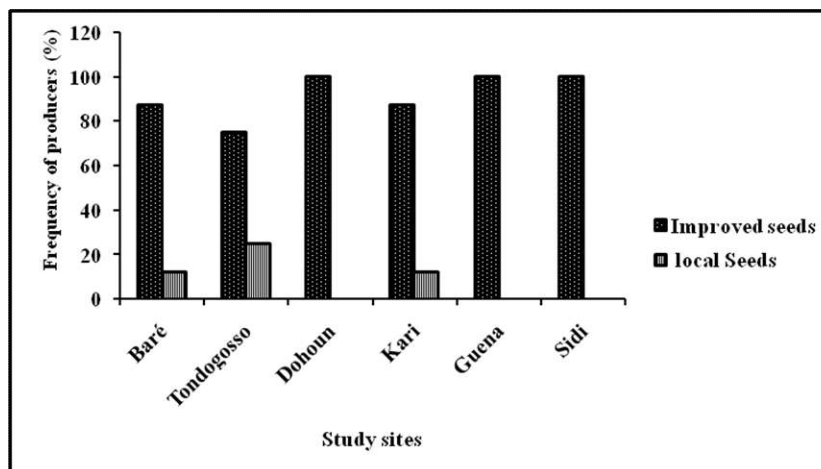
Table II presents the situation on equipment. From our surveys, regardless of the cotton production site (Baré, Tondogosso, Dohoun, Kari, Guéna and Sidi), it appears that 100% of producers own cattle. At the Dohoun site, 87.5% of producers own sheep, followed by Baré and Guéna sites with 75% of producers owning sheep. The Kari site comes with 37.5% of producers. A quarter or 25% of producers have sheep in the Tondogosso and Sidi sites. With regard to goats, the producers of Baré, Dohoun and Guéna take the lead with 87.5%. On the other hand, in the village of Kari, there are 37.5 producers and 25% for Tondogosso and Sidi. It should be noted that 100% of Baré producers have equines followed by Tondogosso producers with 37.5% and 25% of producers at

Table 3. Parcel Acquisition Mode

Mode of acquisition	Proportion of producers per agricultural production site (%)					
	Baré	Tondogosso	Dohoun	Kari	Guéna	Sidi
Loan	25	-	25	-	-	-
Don	-	12,5	25	-	-	-
Rental	-	-	-	-	-	-
Inheritance	75	87,5	50	100	100	100
Purchase	-	-	-	-	-	-

Table 4. Soils types exploited in cotton-crop

Soil type	Proportion of producers per agricultural production site (%)					
	Baré	Tondogosso	Dohoun	Kari	Guéna	Sidi
Clay	25	37,5	62,5	50	25	87,5
Silty clay	25	-	-	-	25	12,5
Gravionnaires	50	62,5	37,5	-	-	-
Sandy	-	-	-	50	50	-

**Figure 1. Types of seeds used****Table 5. Cotton harvesting method**

Methods	Proportion of producers per agricultural production site (%)					
	Baré	Tondogosso	Dohoun	Kari	Guéna	Sidi
Manual	100	100	100	100	100	100
Mechanized	-	-	-	-	-	-

Table 6. Types of equipment used for cotton harvesting

Type of equipment	Proportion of producers per agricultural production site (%)					
	Baré	Tondogosso	Dohoun	Kari	Guéna	Sidi
Cotton bags	-	-	37,5	12,5	-	-
Empty bags of fertilizer	100	100	62,5	87,5	100	100
Baskets	-	-	-	-	-	-

Table 7. Location of storage of harvested cotton

Storage location	Proportion of producers per farm production site (%)					
	Baré	Tondogosso	Dohoun	Kari	Guéna	Sidi
In the field	87,5	100	75	100	100	87,5
At home	12,5	-	25	-	-	12,5

the Dohoun and Sidi sites. No producer of the Kari and Guéna sites owns an equine. Only 75% of Baré producers and 25% of Sidi have pigs. Finally, 87.5% of producers who own poultry are nationals of the villages of Baré and Guéna, followed by Tondogosso and Dohoun with 75% of producers, 37.5% in Kari and 25% in Sidi.

Parcel acquisition mode: The results of the statistical analysis show that the majority of producers have acquired their

agricultural parcel by inheritance with 100% in Kari, Guéna and Sidi and respectively with 87.5% and 75 of the producers of Tondogosso and Baré (Table III). From our surveys, we note that 25% of producers have borrowed their agricultural parcels. It should be noted that 25% and 12.5% of the producers of Dohoun and Baré, respectively, acquired their farms by donation. Finally, regardless of the village, no producer has acquired his agricultural parcel either by rent or by purchase.

Cotton harvesting method: Table V shows the cotton harvesting method according to the production sites surveyed. Regardless of the production site, all producers harvest the cotton manually. On the other hand, none of them uses the mechanized method.

Types of equipment used for cotton harvesting: At all sites, producers use bags for the conditioning of cotton (Table VI). It is noted that 100% of the producers of the sites of Baré, Tondogosso, Guéna, Sidi and 62.5 and 87.5% of the producers respectively of the sites of Dohoun and Kari use the empty bags of fertilizer for the conditioning cotton. Only 37.5% and 12.5% of producers use cotton bags for cotton packaging. On the other hand, no producer of the sites of Baré, Tondogosso, Guéna, Sidi uses the cotton bags. In addition, regardless of the cotton production site, no producer use baskets for packing cotton at harvest.

Place of storage of harvested cotton: The results in Table VII show the location of cotton storage per production site. All the producers surveyed at the Tondogosso, Kari and Guéna sites store their cotton in the field as well as 75 and 87.5% of the producers respectively in the Dohoun and Sidi sites. On the other hand, a minority of producers 12.5% of the sites of Baré and Sidi and 25% of Dohoun store the cotton harvested at home. No producer uses this practice at the Tondogosso, Kari and Guéna sites.

DISCUSSION

Regardless of the location, each grower has a plow, cart, weeder, hitter, ox pair and sprayer. This could be explained by sensitization sessions, information on good agricultural practices as well as support for state services and development projects that take place in these production areas. These results are in agreement with those of Aïwa Aïwa (2015) who showed during his work that in Khorogo in the North of Ivory Coast that the team reduced the hardness of the work and contributed to increase the number of farms and to reduce unemployment in rural areas. In addition, this has made it possible, compared to manual tools, to gain in terms of working time and comfort, to employ less labor and to have the possibility of cultivating larger areas. According to Tapsoba, (2013) the work done by animal traction can be 5 to 20 times higher than with manual tools, especially for plowing. The use of draft animals provides economic benefits well beyond exploitation. Transport by animal drawn carts facilitates the marketing of products and stimulates local trade (Ouédraogo, 2016).

Animals can also be an important means of local transport between farms and roads, thus completing motorized road transport systems (Tapsoba, 2013). On the other hand, no producer owns a tractor as farm equipment. The high cost of the tractor is one of the main reasons. The majority of producers own cattle, sheep and poultry. This could be explained by the interest of the producers in these localities in breeding. These results are consistent with those of Traoré, (2016) who showed that agricultural producers integrate livestock into their agricultural activities. The integration of these two fields of activity is perceptible throughout the Hauts-Bassins region (Tapsoba, 2013). Thus, well-equipped farm households use animal traction in land preparation (plowing, scarification, ridging), crop maintenance (weeding, hilling) and transport. According to Vall et al (2002), the majority of

production units are equipped with animal traction. The work of Blanchard et al., (2008) has also shown that more than the majority of production units (UP) have, at least, a tillage tool and at least one donkey or oxen. Our results are in agreement with those of (Tapsoba, 2013) who showed that farms are most often well equipped with plows, weeding tools and hilling tools. However, they do not have mechanical seed drills. The sowing operation is almost always performed manually onlines (Malo,2016). The majority of producers acquired their agricultural parcel by inheritance. Access to land remains limited and reduces the possibility of increasing area and hence total production. Producers grow cotton on clay soils. This could be related to the nature of the soil of cotton growing sites. The majority of the soils of these cultivation sites are leached tropical ferruginous soils (Ouédraogo, 2016). Producers use improved seed of cotton on their farms. They report using the improved seed to increase yield. Our results are in agreement with those of Malo (2016) who showed that the use of improved seeds remains linked to the availability of inputs. Regardless of the production site, all producers harvest the cotton manually. This would be related to the high cost of harvesting equipment. These observations are consistent with the results of the work conducted by Sanon, (2013) who highlighted the high cost of harvesting equipment. Manual mechanization is the use of human muscle strength with very simple tools (Aïwa Aïwa, 2015). At present it is the most widespread level of mechanization in small farms in developing countries (Sanon, 2013). The energy and tools available often limit the user to subsistence farming. It includes a variety of tools such as machetes and hoes designed in a simple way and manufactured locally. These tools are easy to repair, maintain, manufacture and use. They also offer the advantage that they are socially accepted and remain very cheap. However, they require a significant use of labor, they pose a problem of hardship and finally they do not allow to sow large areas (Tapsoba, 2013). The majority of producers surveyed store their cotton in the field. This could be justified by a lack of warehouse for storage and packaging of cotton. This observation was made by Pouya, (2013), who mentioned the difficulty of storing post-harvest cotton in the field.

Conclusion

This study is a contribution to a better knowledge of agricultural production equipment in order to ensure the sustainability of production systems in Burkina Faso. Agricultural mechanization of cotton growers appears as a production technology of the future and is part of the development strategies of the Burkinabe government to improve the incomes of rural populations. Despite the efforts made by the development departments, research on the production of this plant remains limited. The cotton crop is facing several difficulties related to the production technology whose consequence is the decline of its productivity. The results of our work based on the investigations made at the production sites show the following: 1) the agricultural equipment varies according to the knowledge that the producer has of the culture; 2) agricultural equipment is used by producers in cotton growing; 3) the use of agricultural equipment is a function of the activities on the cotton farms. In perspective, it will be necessary to continue work on the agricultural mechanization of cotton growers in order to propose accessible and inexpensive technologies for rural populations.

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