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Research Article

Understanding the Farming Practices of Farmers Displaced from a Semi-rural Area for their Better Settlement on new Lands in Burkina Faso

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ABSTRACT

Farmers from the urban, peri-urban and semi-rural areas very often have to free their land for the benefit of constructions and move to other areas because of the continuous expansion of cities and the growing need for larger infrastructures. Those displaced smallholder farmers have to settle on new lands more often very degraded which therefore require an appropriate management to sustain good yields. In this study, we analyzed the constraints and opportunities of the displaced farmers of the semi-rural area of the Donsin airport in Burkina Faso. Data on cropping practices like crop types, mineral and organic inputs, use of pesticides and improved seed, the constraints related to crop production and information on socio-economic conditions of the farmers were collected using a semi-structured questionnaire. We found that more than 50% of the farmers were illiterate and about 60% never received a training on good cropping practices. About 60% use no certified seed and 24% do not apply organic amendment. Two banned pesticides containing Indoxacarb, carbofuran and Lambda-cyhalothrin were recorded. Constraints to the access of water resources, inputs and arable lands were mentioned by the majority of the respondents. For a better wellbeing of the affected smallholder farmers we recommend a collaboration between the farmers and the authorities so as to promote the intensification of farming practices and a better management of the available resources.

Key words: Displacement of farmers, semi-rural agriculture, farming practices

INTRODUCTION

Agriculture remains an important sector which plays economic and socio-cultural role in developing countries. Indeed, it employs about 85% of the population (Hauchart, 2007) and most of Sub-Saharan African countries earn about 55% of their resources from this sector (Davis *et al*., 2017). The African agriculture is characterized by the diversity of the cropping practices leading to a diversity of yields in urban as well as in semi-rural and rural areas (Kiba *et al*., 2012). In the urban areas of Burkina Faso like in most African countries, whereas agriculture is mostly focused on fresh vegetable production, in semi-rural and rural areas it is mostly based on cereals, legumes, root and tuber crops and other cash crops like cotton. The cash crops are produced on large surfaces and benefit from technical and financial support of the industrial companies while food crops are mostly produced by smallholder farmers on small pieces of land, with very little inputs and little technical support.

Smallholder farmers in Africa are facing a lot of challenges namely the lack of finances to gather inputs (Adjognon *et al*., 2017), the limited technical support from the extension agencies (Msuya *et al*., 2017) and the lack of a proper land tenure which seriously limits the development of agricultural sector (Korsaga, 2018). Due to the continuous expansion of cities and the growing need for larger infrastructures to cope with a growing population, smallholder farmers in urban, peri-urban and even semi-rural areas very often have to free their land for the benefit of these infrastructures and move to other areas. Naab *et al*. (2013) showed for the region of Tamale in Ghana a negative impact of urbanization on the poor farming communities due to the loss of agricultural lands that serve as main source of livelihoods to those communities. In Burkina Faso, the international airport of Ouagadougou which was initially out of the city is now totally engulfed and is now almost in the center of the city. The project of the construction of the new airport of Donsin located in

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a semi-rural area (25km from Ouagadougou) affected about 3000 smallholder farmers (MOAD, 2011). These displaced smallholder farmers have to settle on new lands, most of which are degraded. It was therefore imperative to understand their past farming practices in order to identify capacity building needs and provide them with the technical support necessary to ensure good crop productivity. In this study, we identified the opportunities and the challenges regarding the cropping practices of the displaced farmers of the Donsin airport and characterized their socio-economic conditions. We then analyzed the information gathered and finally addressed recommendation for decision makers and the farmers.

MATERIALS AND METHODS

Study sites

The study was conducted in Donsin (12° 35 '01" North latitude and 01° 24' 06" longitude West) located 25 km northeast of Ouagadougou within a project of a new airport construction. It includes totally or partially 10 villages: Bagayiri, Donsin, Kogninga, Kourityaoghin, Rogomnogo-Nongstenga, Silmiougou, Tabtenga and Zongo in the commune of Loumbila; Kartenga and Taonsgo in the commune of Ziniaré and Voaga in the commune of Dapélogo. This airport area covers 4 400 ha (50% of ten villages area) and has been declared by the government in 2011 as zone of public utility for the construction of the Donsin airport and its access roads Décret n°2011-228/PRES/PM/MEF/MATD/MID). This led then to the displacement and relocation of the affected population which is around 45% of the ten villages' populations (MOAD 2011).

The climate of the zone is of Sudano-Sahelian type which is characterized by a rainy season (June to October) and a dry season (November to May), with an annual precipitation between 600 to 900 mm (Fontès and Guinko, 1985).

The land use of the area is as follow: cropped land: 83%; fallow 6%; forest, riparian formations, parks, groves and shrub savanna: 4%; naked land: 2%; mounds: 2%; water and flooding land: 2% (MOAD, 2011).

Survey

Interviews were conducted in 2012 during the rainy season (July and September) and based on person directly affected by crop production in the airport area. In total, 65 farmers, 10 traditional authorities, 21 stakeholders' organizations and 18 technicians of agriculture from the ministry of agriculture were interviewed either individually or in focus group.

The semi-structured questionnaire was designed and pretested on 10 randomly selected persons. After the pretest, the questionnaire was then adjusted to capture reliable information on: i) Socio-economic conditions of the farmers, ii) crop types, iii) inputs used (mineral and organic fertilizers, pesticides and seed) and, iv) the constraints related to crop production.

Data analysis

Data collected were analyzed by descriptive statistics using Minitab (V.18) Statistical Software for Windows (Minitab Inc.).

RESULTS

Socio-economic conditions of the farmers

All level of education was encountered within farmer population as shown in Table 1. Around half of farmer (54%) are illiterate, and the second half had a schooling level. It is worth to note that few farmers (2%) were high educated.

Farmers were occasionally trained as only 38% of them were trained on efficient use of fertilizers and pesticides. However, most of them (62%) belong to farmer's organisations or associations.

Cropping practices

Crop types

Most of the farmers (83%) produced both grains (cereals and legumes) and vegetables. Farmers having a single crop type meaning grain or vegetables represented 5% and 12% respectively.

Seed

Farmers used preferentially their own seed from previous production (60%). Certified improved seeds from seed producers are used by 18% while 22% used local varieties.

Fertilizers

Table 2 showed the proportion of farmers using mineral fertilizer and/or organic amendments. Mineral fertilizers (NPK and urea) were applied either alone or in combination with organic amendments (compost and manure) by 96 % of the farmers. One third of the farmers applied together NPK, urea and organic amendments.

Two (02) modes of fertilizer application, broadcasting and deep soil application were used by 72% and 28% of the farmers, respectively. Organic amendments were always broadcasting applied.

Pesticides application

All the farmers claimed that they used chemical pesticides as they cultivated vegetables and cowpea. A total of 12 different pesticides were reported (10 insecticides and 2 herbicides) as shown in Table 3. However, most of the pesticides used were authorized by the Sahelian Committee for Pesticides (CSP 2018) only for Cotton. Two (02) pesticides were banned. The most common active ingredients

Table 1: Education level of farmers in the semi-urban airport area of Donsin

Education level	Percentage of response
None	54
Primary	29
Secondary	15
University	2

Table 2: Type of fertilizers used by farmers in the semi-urban airport area of Donsin

Fertilizer type	Percentage of utilization (%)
NPK only	23
Urea only	1
Organic amendments only	4
NPK + urea	34
NPK+ Organic amendments	5
NPK + urea+ Organic amendments	33

Table 3: Pesticides used by farmers in the semi-rural airport area of Donsin as classified by the Sahelian Committee for Pesticides (CSP) notice 2018

Trade name	Active ingredients	WHO toxic Class (*)	Authorized use
Insecticides			
ATTAKAN C 344SE	Cypermethrin (144g / l) Imidacloprid (200g / l)	II	Insecticide authorized against phyllophagous caterpillars, and carpophagous and sucking insects of cotton
CONQUEST C88 EC	Cypermethrin (80 g/l) Acetamiprid (16 g/l)	II	Insecticide authorized against phyllophagous caterpillars, and carpophagous and aphids of cotton
CURACRON 500 EC	Profenofos (500 g/l)	III	Insecticide / acaricide authorized against major insect species phyllophage and carpophage and mites of cotton
CYPERCAL P 230 EC	Cypermethrin (30 g / l) Profenofos (200 g / l)	II	Insecticide / acaricide authorized against phyllophagous caterpillars, and carpophagous and mites of cotton
DECIS 25 EC	Deltamethrin (25 g/l)	II	Insecticide authorized against *Helicoverpa* in tomato cultivation
FURADAN	Carbofuran (5%)		(**)
K-OPTIMAL	Lambda-cyhalothrin (15g / l) Acetamiprid (20g / l)		Insecticide authorized against pests for cabbage and cotton
LAMBDACAL P 212EC	Lambda-cyhalothrin (12g / l) Profenofos (200g / l)	II	Insecticide authorized against phyllophagous insects and carpophage for cotton
MORAN 30 DF	Indoxacarb (300g / kg)		(**)
PACHA 25EC	Lambda-cyhalothrin (15g / l) Acetamiprid (10g / l)	II	Insecticide authorized against pest caterpillars and biting-sucking insects of tomato
Herbicides			
GLYCEL 410 SL	Glyphosate (410g/l)	II	Systemic non-selective herbicide authorized against annual and multi-year crop weeds
IKOKADIGNE	Holoxyfop-R methyl (104g/l)	II	Post-seedling weed selective herbicide authorized for extension of use against grasses in onion culture Pre-seedling herbicide authorized against young grass shoots in cotton

(*): World Health Organization (WHO) class. II: moderately hazardous; III: Slightly hazardous: (**): Not authorized by CSP at date

Table 4: Constraints related to crop production according to farmers in the semi-urban airport area of Donsin

Domain	Constraints
Inputs	- The availability of agricultural inputs (pesticides and fertilizers and seed)
	- The high cost of agricultural inputs
	- The rudimentary means of dewatering (hoe, machete, rake, squeezes, watering can, bucket, etc.)
	- Lack of training on efficient use of agricultural inputs
Arable land	- The gradual disappearance of fallow
	- The low rate of use of organic amendments
	- The lack of training in integrated soil fertility management
	- Low soil fertility
	- The inadequacy of hydro-agricultural schemes
	- Land tenure

ingredients found were: Acetamiprid, Cypermethrin, Lambda-cyhalothrin, Profenofos, Carbofuran, Deltamethrin, Glyphosate, Holoxyfop-R methyl Imidacloprid and Indoxacarb.

The insecticide most commonly encountered in the area was Decis 25EC, used by 84.6% of the farmers. Almost all the farmers (98.5%) used mechanical spraying method to apply pesticides. Broom sprinkling method of application was used by 1.54% of the farmers

Constraints

Water resources

Voaga and Nonstenga, the two out of the 10 villages had a dam. Three villages, Kourityaoghin, Rogomnogo and Tabtenga had perimeters in the main branch of the watercourse supplying the Loumbila dam. There was no dam in Silmiougou, Kartenga and Donsin villages. The other two villages had one or two ponds and wells. However, the survey indicated that one third of the vegetable growers had their sites on their villages, the second third had the site in the border villages and the last third in the remote villages.

Water availability in term of water shortage, distance from site, and access were mentioned respectively by 43.1%, 33.8% and 23.1% of the farmers as challenges for vegetables production.

About 26% of the farmers used only dams as water resources to mainly produce tomato but also eggplant, pepper, carrot, zucchini, lettuce, okra, onion, spinach leaves, cucumber, cabbage. They were moving from dam to dam.

Most farmers, 69%, were installed around dams and dig sumps as an alternative to dams drying out. Dams tended to dry out sequentially from January at Nonstenga, February at Voaga, March at Tabtenga and Goue. The dams of Kourityaoghin and Rogomnogo were close to Loumbila dam and then rarely dried out. However, 5% of the farmer used only wells in dry season to irrigate small tomato and eggplant gardens.

Cropping

The constraints to crop production were categorized in inputs and arable lands by farmer's traditional authorities, stakeholders' organizations and technicians of agriculture as summarized in Table 4.

DISCUSSION

Low education level is common situation in non-industrial crop production in Sub Saharan Africa (Shimeles *et al*., 2018). Similar or higher percentage of our results were reported by Nare *et al.* (2015) in three cities of Burkina Faso. Moreover, the same figure was reported in three West African cities, Bobo Dioulasso (Burkina Faso), Kano (Nigeria) and Sikasso (Mali) by Abdulkadir *et al*. (2012) or even in Latin America and Asia (Waichman *et al.* 2007). Contrary to our results, Adjrah *et al*. (2013) indicated that only 6% of the farmers are illiterate along the Littoral of Togo.

Education level certainly facilitate training as the more farmers are educated, the easy they would understand and apply agricultural good practices. The higher illiterate proportion of farmers could be then a barrier to the use of good practices. In our study, the higher educated farmers were rare. This could be explained by the fact that the holder of higher degree would be more oriented to intellectual formal position rather than land cultivation (Livingston *et al*., 2011). Our results showed that only 38% of the farmers were trained in the use of fertilizers and pesticides indicating that there was a high risk of misused of these inputs. Indeed, the lack of knowledge of approved pesticides, the rate of mineral fertilizer and the periods of application during the production cycle remain detrimental to ensure a good crop yield. However, one third of the farmers applied together NPK, urea and organic amendments as recommended by extension services.

The organization in association or village group constituted a favorable framework to benefit from training, demonstration tests or farmers' fields school, and subsidies or access to credit on agricultural inputs. This explain why two-third of the famers joined those organizations. Despite training and sensitizing organized by extension services, most of the farmers do not participate because they do not always appreciate the interest of the training. As consequences agricultural good practices are not much applied (Muzari *et al.*, 2012).

Intercropping system is a common practice that mixed cereal (sorghum, maize) with leguminous (cowpea, groundnut) in the same piece of land and is usual in the rural zone (Tignegre *et al*., 2018). For the farmers, it is a way to diversify diet and revenues but also to mitigate climate change. However, cowpea is a cash crop and then pure culture was practiced by some farmers.

Improved seed appeared to be very little adopted as compared to farmer' own seed. In fact, when farmers purchase certified seed from seed companies or research centers, at harvest time, they select the big ears well formed as seed for the next season. This was generally done ones or twice before buying a new certified seed. Certified seed cost and availability and also some sociocultural factors were often advanced as limits to their used (Djamen and Ouattara, 2017). Local varieties were still used because there are suitable for the agroclimatic conditions and also for some social and diet purposes.

Mineral and organic fertilizers are widely used due to the inherent low soil fertility (BUNASOLS 1990; Bationo *et al*., 1998). They are indeed appreciated by the farmers through their nutrient supply and their ability to loosen the soil, thus facilitating the penetration of roots and the holding soil moisture. However, inappropriate application of these fertilizers such as broadcasting application or under rating would limit crop yields.

This study showed that farmers used chemical pesticides to manage pest and disease on vegetables and grain crop, but almost all the pesticides were those recommended for cotton. Our results corroborated with many studies in developing countries (Mengistie *et al*., 2017; Nguyen *et al*., 2018; Son *et al*., 2018). These cotton pesticides had high concentration of active substance which may lead to poisoning of farmers, crop and dam contamination. The use of inappropriate pesticides is explained by the low level of education (Toé *et al*., 2013). Indeed, illiterate farmers were unable to read instructions on the packaging, and then would be likely influenced by the retailer and other farmers.

The scarcity and availability of water in the region were the main constraints of vegetable production. Water shortage would lower the yield while increasing the production cost; the annual revenues could be the quarter of normal season. Indeed, location of dams and the drying up period constrained farmers to move from village to village for their activities. Generally, migrant farmers would borrow land, and the less fertile land and the farthest from the water source were given to them. However, large farmers, own sites around the different dams and move also as when water shortage occurs. Tomato is the most popular vegetable produced in the zone and sold on-spot or in the capital Ouagadougou. Some of the farmers, even the dam was dried up, would stay and dig well for irrigation. Thus, surface was reduced drastically and only tomato and eggplant were grown.

Other constraints pointed out was related to training in irrigation system and dam management. The different water agencies covering all the territory were created for better planning and water resources management. It was argued that appropriate water management could delay the drying up of the dam for happiness of farmers.

Conclusions

The results of this study indicated that the population affected by the new airport of Ouagadougou were mostly illiterate and produce grains crop and vegetables around the dams. They commonly use inputs such as fertilizers, improved seeds and pesticides, although cotton pesticides were most often applying on vegetables. The main constraints for crop production included water shortage, the availability of agricultural inputs, lack of training on efficient use of agricultural inputs and land tenures.

To promote better wellbeing of the affected smallholder farmers by the building of the new airport, the following recommendations are addressed1) to the local authorities: i) to organize trainings on the use of agricultural input specifically on pesticides, and ii) to create a specific organizational framework for the water management and market garden sites; 2) to the producers : i) to apply the good agricultural practices and to promote the agricultural intensification, and ii) to create management committees in the different sites in order to stimulate a dynamic of accountability in the management of development; and finally 3) to the Contracting Authority of Donsin Airport : i) to ensure the rehabilitation and maintenance of existing hydro-agricultural structures and ii) to ensure the development of small perimeters.

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