

Received: 08/16/2019

Accepted: 08/28/2021

GREEN MAIZE GROWN IN FAMILY FARMS IN CÁCERES COUNTY-MT: CHALLENGES AND PERSPECTIVES FOR RURAL DEVELOPMENT

MILHO VERDE NA AGRICULTURA FAMILIAR EM CÁCERES-MT: DESAFIOS E PERSPECTIVAS PARA O DESENVOLVIMENTO RURAL

Jucimar Ferreira Neves¹

Sandra Mara Alves da Silva Neves²

Santino Seabra Júnior³

Junior Miranda Scheuer⁴

Nicolý Seabra Botti⁵

Abstract

Green maize is featured as viable alternative to generate income in family establishments, since it is a productive and highly-valued culture in the vegetable crop market. However, it is necessary identifying the weaknesses preventing such a culture from contributing to family farming development. The aim of the current study is to feature the family production of green maize in Cáceres County, Mato Grosso State, based on the rural development perspective. Information was collected through semi-structured interviews, photographic records and field observations. Low schooling level, in association with lack of policies focused on providing technical assistance and rural credit to family farmers, were mentioned as the main factors limiting the optimization of green maize crops, mainly with respect to the use of technologies and agrochemicals, and to deficient infrastructures. It was possible concluding that family farming focused on green maize culture presents deficiencies, mainly in terms of public policies, social organization and environmental care.

Keywords: Agricultural-social-environmental featuring. *Zea mays*. Family farmers. Mato Grosso State. Regional development.

Resumo

¹ PhD student in Agronomy/Vegetable Production at the Federal University of Grande Dourados. Substitute Professor at the State University of Mato Grosso, Cáceres – MT, Brazil. E-mail: jucimarferreira@globocom

² PhD in Science (Geography) from the Federal University of Rio de Janeiro. Professor at the State University of Mato Grosso, Cáceres – MT, Brazil. E-mail: ssneves@unemat.br

³ PhD in Agronomy (Horticulture) from Universidade Estadual Paulista Júlio de Mesquita Filho. Professor at the State University of Mato Grosso, Nova Mutum – MT, Brazil. E-mail: santinoseabra@hotmail.com

⁴ PhD student in Agricultural Sciences at the Universidad de la República, Udelar. Assistant Professor at the Facultad de Agronomía at the Universidad de la República, Montevideo, Uruguay. E-mail: juniorscheuer@yahoo.com.br

⁵ Technologist in Agribusiness at the Faculty of Technology of Itapetininga (FATEC), majoring in Agronomic Engineering at the University of Sorocaba – SP, Brazil. Email: nicolybotti@hotmail.com

O milho verde caracteriza-se como alternativa viável para a geração de renda em estabelecimentos familiares, trata-se de uma cultura produtiva e muito valorizada no mercado de olerícolas. No entanto, é necessário identificar as debilidades que impedem que tal cultura contribua com o desenvolvimento da agricultura familiar. O objetivo foi caracterizar a produção familiar do milho verde do município de Cáceres, Mato Grosso, na perspectiva do desenvolvimento rural. O levantamento de informações ocorreu por meio de entrevistas semiestruturadas, registros fotográficos e observações de campo. Observou-se baixo nível de instrução e escolaridade que aliados à falta de políticas de assistência técnica e crédito rural foram citados como os principais fatores limitantes à otimização do cultivo do milho verde, sobretudo quanto ao uso de tecnologias e agroquímicos, além da deficiência em infraestrutura. Conclui-se que há deficiência na agricultura familiar envolvida no cultivo do milho verde, principalmente quanto a políticas públicas, organização social e cuidados com o meio ambiente.

Palavras-Chave: Caracterização agrosocioambiental. *Zea mays*. Agricultores familiares. Mato Grosso. Desenvolvimento regional.

Introduction

Family farming accounts for producing a considerable part of the food consumed by Brazilian citizens. According to Hoffmann (2014), 21% of the total national food production derives from family farming, mainly that of products such as cassava (87%), beans (70%), pigs (59%), milk (58%), poultry (50%), maize (46%), coffee (38%), rice (34%), cattle (30%), wheat (21%), soy (16%), among others (FRANÇA et al., 2009).

Brazilian maize production in the 2018/2019 harvest has reached approximately 111 million tons: 72% of it was subjected to industrialization processes; 15% was used for human consumption; and 13% was consumed fresh in the form of green maize (ABIMILHO, 2019).

Maize grain production is highly investigated by the academic community of Mato Grosso State, as well as at national level, because it is a highly profitable segment focused on agribusiness based on commercial agriculture. However, green maize exploration for fresh consumption requires further investigation (CARDOSO et al., 2004), since this segment is mainly taken by small rural properties – i.e., by family farmers.

Green maize is a vegetable with high added value (RODRIGUES et al., 2018); it is one of the most common farming production activities performed in Brazilian rural establishments. Despite the hard time gathering reliable and up-to-date statistical data about it, green maize production is mainly adopted by family farmers, whose production is used for domestic consumption (family and animal), for trade *in natura* in large consumer centers' vicinities and in food processing industries (TSUNECHIRO; MIURA, 2012; REGITANO-D'ARCE et al., 2015; MATOS et al., 2017, PEREIRA FILHO et al., 2019).

Cáceres County, Mato Grosso State, most specifically the district of Caramujo, stood out in 2011 for the largest *pamonha* (green maize by-product) production in Brazil - it was registered in the RankBrazil of national records (RANKBRASIL, 2011). This achievement highlights the importance and appreciation of green maize production by family farmers and by the population living in this region.

Thus, it is important understanding the reality of green maize production by family farmers, as well as its social and economic importance for rural families living in Cáceres County. The outcomes of the current investigation helped better understanding the internal dynamics and degree of family farms' integration to the current economic, agricultural and social system. These findings are expected to contribute to the development of effective actions and policies aimed at family farming development. According to Santana et al. (2013), rural development requires constant investigation about limitations observed in the operating mode adopted by rural families.

In light of the foregoing, the aim of the current study was to feature family green maize production in Cáceres County, Mato Grosso State, based on the rural development perspective, with emphasis on family farming.

Theoretical background

The current study has focused on maize (*Zea mays* L.) production, since it is a versatile cereal that can be consumed in its dry form (dry milling – cereals, flours, cornmeal, bran, oils – wet milling – starch, dextrin, syrup, oil, fiber, gluten, among others) and in the form of green grains (cooked, roasted, *pamonha*, *curau* (sweet custard-like dessert), cake, canned, frozen, dehydrated, among others). Yet, it can be used to produce chemical, pharmaceutical, beverage and fuel (corn ethanol) by-products, among others (REGITANO-D´ARCE et al., 2015).

Green maize production makes high social and economic contribution to family farming (CARDOSO et al., 2004; REBOLLAR et al., 2010). Its social contribution is associated with the employability of family labor force, as well as with interpersonal relationships between farmers and the local market. On the other hand, its economic contribution lies on generating indirect (by-product for other activities) and direct income (marketing - growing demand by industries - PEREIRA FILHO et al., 2019). These contributions help reducing rural exodus and strengthening family farming (SIMÕES, 2006; MATOS et al., 2007), which are axes associated with regional (NESPOLI et al., 2015) and rural development.

The concept of development encompasses different approaches, interpretations and implications associated with different aspects, mainly the economic, social, environmental, political and human ones (VAN DEN BRULE et al. 2018). The topic “rural development”, in Brazil, remains closely linked to concepts imposed by the “Green Revolution”. This concept was based on increasing agricultural yield through actions taken by the Federal Government and international organizations in agricultural modernization processes. Among these actions, one finds importing technological packages, and this strategy has increased the country’s external dependence and linked agriculture to a non-renewable energy matrix (WEISHEIMER, 2013).

Family farmers have entrepreneurial and innovative nature, since they are able to diversify territories occupied by them. Based on agricultural, social and economic aspects, it has direct influence on territorial and rural development processes. In addition, spatial differences in development processes mostly result from social, economic, environmental, institutional, demographic changes capable of defining rural development processes taking place in each space (ABRAMOVAY, 2003).

Identifying differences featuring each rural region helps better understanding developmental limitations and enables more qualified public and private discussions and actions focused on achieving the expected rural development goals (SOUZA, 2019). However, such a development process faces challenges, such as deficient infrastructure and logistics; need of processing and marketing rural production; farmers’ low schooling level of farmers, which hinders technical assistance and production encouragement actions; land regularization; agrarian reform; and the establishment partnerships/businesses, among others (SILVA, 2011).

According to Scheuer, Vassallo and Gravina (2019), there is a gap in the development of undercapitalized (lower income) agricultural establishments in comparison to the capitalized ones (higher income). However, the fostering strategy adopted by public institutions and government programs, which are associated with technical assistance programs, can enhance and diversify family farmers’ income, as well as indirectly account for broadening such an activity (SCHEUER et al. 2016).

Institutions and rural families must adopt proactive attitudes to enable constant learning and training, in addition to develop rural administration/management strategies capable of optimizing processes, promoting the adoption of new organizational methods and increasing competitiveness and professionalization among family farmers, so they can develop the family farming segment (TIGRE, 2006).

According to Simioni, Binotto; Battiston (2011), it is necessary identifying information associated with producers’ learning and management processes. In addition, substantial part of family farming development depends on extension services, since using conventional technical material in Brazil is inefficient without professional help, given the low schooling level faced by several family farmers.

Extension services have declined in recent times; thus, matters associated with information collection and outspread, as well as with training on how to use such an information, are a bottleneck in family farming development processes. Accordingly, socioeconomic studies enable analyzing the structural conditions of rural family properties, since they are dynamic tools capable of capturing the variables forming the family farming profile (FERNANDES; LIMA, 1991; SILVA; MARTINS,

2004). Assessment results enable establishing tools to deal with observed weaknesses to promote family farming and rural development, itself.

Materials and Methods

Study site

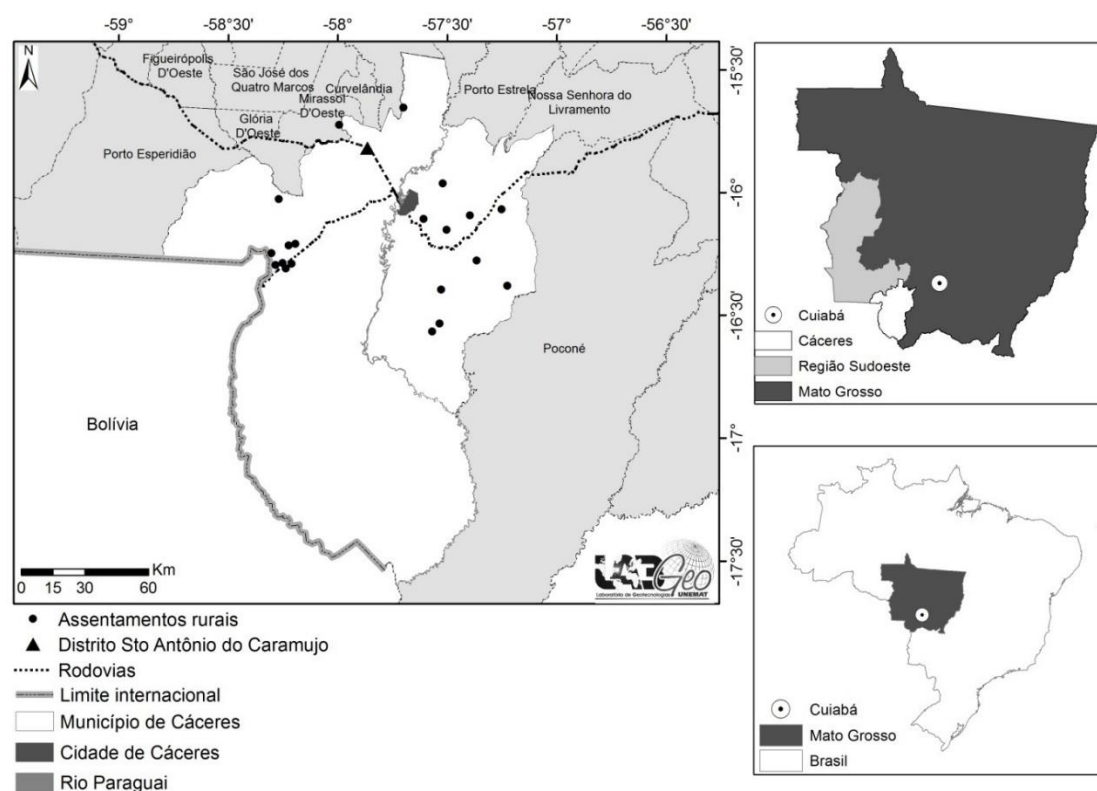
Cáceres County is located in the Southwestern planning region of Mato Grosso State, in the micro-region of Alto Pantanal, 215 km away from the state capital. It is located between latitudes 15° 27' and 17° 37' South and longitudes 57° 00' and 58° 48' West, and its territorial extension covers 24,351,408 km² (IBGE, 2019a) (Figure 1).

Cáceres is located in the Amazonian, *Cerrado* and *Pantanal* biomes (IBGE, 2019b), a fact that evidences its agroecological diversity. According to Köppen's classification, the climate in the county is of the tropical hot and humid type, with dry winter (Awa); mean annual temperature reaches 26.25°C (NEVES et al., 2011).

Cáceres' population comprises 87,942 inhabitants (IBGE, 2019a); its Municipal Human Development Index is 0.708, which is classified as high human development, although it is lower than values observed for the State (0.725 - high), and for Brazil (0.730 - high) (PNUD, 2013).

Livestock is the main economic activity in Cáceres County, which holds one of the largest cattle herds in Brazil (IBGE, 2019c). Large-scale agriculture is little explored in the county, whereas family farming is an income and subsistence alternative for local families, which is reinforced by federal rural settlement and territory colonization programs.

Figure 1: Location of Cáceres and rural settlements in Mato Grosso State



Source: Elaborated by the authors (2019).

Methodological procedures

The research was conducted in May 2014, with family farmers who grow green maize in Cáceres County. Information to help identifying and locating the family farmers in the region were obtained by consulting local representatives of the Rural Workers' Union, as well as in agricultural stores, local supermarkets and rural producers' fairs. In addition to these consultations, and based on the authors' prior knowledge, some family farmers were found through the "Snowball Sampling"

methodology by Goodman (1961), according to which interviewees name other individuals to be interviewed.

Thus, 15 family farmers presenting current green maize output in the county were identified, but 2 of them did not accept to participate in the research. Thus, the final sample counted on 13 family farmers.

Semi-structured interviews were carried out with the person in charge of the agricultural establishment or with that looking over the green maize crop. The semi-structured interview form (previous script – TRIOLA, 2004) comprised 103 open and closed questions, aimed at featuring:

- family farmers producing green maize (age, schooling, technical training, traditional knowledge, marital status, generational succession, labor force, income, cost control and public policies);

- rural properties (land title, location, land size, electrification, water resources, preservation areas and production system);

- green maize production system (production longevity, destination, marketing, culture, technical assistance, access to information and perspectives).

The investigation procedure was only carried out upon respondents' consent, based on the application of ethical research standards established by the Research Ethics Committee (CEP) of Mato Grosso State University (UNEMAT), which granted approval for the implementation of the current study (n. 641,199).

Collected data were tabulated in Excel spreadsheet (MICROSOFT, 2016) and subjected to descriptive statistics (summary and description of the main features of a given investigated data - TRIOLA, 2004) of absolute (Fa - observed value) and relative frequency (Fr - absolute frequency/sample ratio) to enable generating tables to support the result analysis.

Garmim GPS device, model 60 CSx, was used to georeference the headquarters of the investigated properties for their subsequent mapping and information insertion in the Geographical Database (BDG) developed in ArcGIS 9.2 software (ESRI, 2007).

Results and Discussion

Featuring family farmers who produce green maize

Family farmers living in Cáceres County, Mato Grosso State, were in the age groups 51-60 years and 30-50 years (46%, respectively), whereas 8% of interviewees were older than 60 years. In other words, most green maize producers (54%) presented profile close to that of rural retirement (55 years for women; and 60 years for men – rural aging – GARBACCIO et al., 2018). Family farmers (household heads) younger than 30 years were not identified in the current study.

Most respondents did not complete elementary school. This finding was similar to the one reported by Scheuer et al. (2016), for São José dos Quatro Marcos County, Mato Grosso State. The main factor linked to these data refers to cultural behavior adopted by farmers' parents, i.e., their life priority was not rooted in introductory education, but in daily work at the farm.

Based on the previous reasoning, results recorded for training in technical courses were similar to the ones recorded for schooling (Table 1). Cochev et al. (2014) have observed lesser impacting numbers in Alta Floresta City, Mato Grosso State, mainly among olericulturists; however, 50% of respondents did not complete elementary school.

Table 1: Schooling and technical training level of family farmers producing green maize in Cáceres County

Variables	Fa	Fr
Schooling		
Incomplete elementary school	12	92
Complete high school	1	8
Total	13	100
Training		
Bovine insemination	2	15
Insemination and beekeeping	1	8
Agroecology	1	8
None	9	69
Total	13	100

Source: Field research (2014).

Belchior et al. (2009) have investigated cassava-producing family farming in Cristalina County, Goiás State, and they observed that 70% of respondents did not complete elementary school, on average. The same dimension was observed by Almeida et al. (2006) for family farmers who work with livestock in Caruaru County, Pernambuco State, a fact that emphasizes the educational training fragility lingering in countryside populations.

According to investigation conducted by Moura and Silva (2012) in Igaci County, Alagoas State, technical training, together with popular knowledge, plays essential role in rural families' socioeconomic development, quality of life, permanence in the countryside, and income generation, among others. These factors corroborate an attitude that safeguards environmental sustainability, namely: the premise of healthier environment and human life.

In total, 76% of respondents were married and 24% lived in stable union. Most married (formally or not) farmers (46%) had two children, 31% of them had three children, 15% had one child and 8% had four children. Forty-three percent (43%) of these children were in the age group 21-27 years; 27%, in the age group 13-20 years; 17%, in the age group 5-12 years; and 13% were older than 27 years.

Schooling of family farmers' children was different from that of their parents, since 47% of them completed high school, 40% were attending high school or elementary school, and 13% were attending or had completed higher education. This scenario is associated with the proximity of the investigated properties to Cáceres' municipal headquarter, since the county is the regional reference in the tertiary sector (employability, health and education). Furthermore, it hosts a higher education public institution (Mato Grosso State University), in addition to other private colleges, technical and regular education schools. These features corroborate the schooling levels recorded for the investigated family farms.

The improved educational qualification of farmers' children had impact on their evasion from the countryside, since 60% of them did not work at the farms, 23% worked and studied, and only 17% of them were exclusively focused on activities carried out at the farms. According to Silva and Hespanhol (2009), children who live and/or work with their parents in agricultural properties may underage, i.e., they depend on their parents and are not old enough to have a paid job outside the family. Silva and Hespanhol's statement is associated with what was herein observed - 40% of family farmers' children fit the aforementioned profile.

The evasion of family farmers' children to urban centers in pursuit of professional qualification and quality of life affects the workforce employed in agricultural activities. Thirty-one percent (31%) of the investigated farms did not need to complete the family workforce by hiring new employees, either fixed or day laborers. According to respondents, there is high demand for work at the farms; however, workforce supply is often scarce, and it contributes to the abandonment, or reduction, of agricultural activities by rural families. This scenario has evidenced the need of encouraging young individuals to return to rural family activities, since they have higher schooling, as well as better technical knowledge and condition to manage family businesses, i.e., they mean better prospection of rural development.

In total, 53% of rural families lived on agricultural and livestock activities, i.e., they exclusively survived on results from their agricultural property; 39% of them reported to essentially live on the agricultural activity, and 8% combined agriculture and other commercial activities. The monthly income of 38% of respondents ranged from R\$ 678.00 to R\$ 1,017.00. It was higher than the R\$ 1,356.00 recorded for 23% of them; equal to, or lower than, the R\$ 678.00 recorded for 8% of these farm families; 31% of respondents did not know/want to answer this question (according to prerogative established by REC).

According to Wanderley (2007) and Simonetti et al. (2011), income diversity is part of productive strategies adopted by rural families to face instabilities in agricultural activities (production, yield and pricing/market) and to ensure sufficient resources for their own consumption; production surplus is traded.

According to Schneider (2004, p. 154), the observed peculiarity (diversification) of these families 'businesses' is analogous to that of pluri-active properties, i.e., of "[...] multiple occupational insertions of people [...] of the family [...]", in agricultural or non-agricultural activities in order to achieve economic, environmental and social well-being.

Participants were asked about the profitability of agricultural production. The aim of this question was to identify whether growing green maize (particularly) was a profitable activity, or not. All respondents reported not to control production costs and profits (which is essential to define

productive efficiency - RICHETTI, 2016), but they were satisfied with the outcomes from their activity.

Thirty-eight percent (38%) of respondents have benefited from the National Program for Strengthening Family Agriculture (PRONAF Programa Nacional de Fortalecimento da Agricultura Familiar) and 8% of them benefited from the Food Acquisition Program (PAA - Programa de Aquisição de Alimentos). According to Melo et al. (2012), PRONAF is one of the few programs favoring family farmers; it aims at combating family farmers' space and representativeness losses due to commercial agriculture progress. However, the program, alone, does not have the fundamental tools to promote rural families' development.

Mesquita and Mendes (2012) have highlighted the important role played by family farming in society and emphasized that they should be better respected and be the target of coherent public policies focused on improving family income (rural credit), technical assistance, production chains and marketing (REBOLLAR et al., 2010) and job generation (rural and/or non-rural) conditions, among others, in order to minimize social conflicts and countryside exodus.

The profile of rural properties

According to the survey carried out in the current study, land in 84% of agricultural properties located in the countryside, and around the urban perimeter (periurban) in Cáceres County, were owned by family farmers. There were also occupations along BR 174, in the periurban area of Caramujo district (which belongs to Cáceres County - 8%) and others (8%) were located approximately 20 km from it.

Only three of the thirteen investigated properties were associated with rural settlement projects financed by the federal government, one of them in Arraial Santanta settlement (1); and two, in Facão/Bom Jardim settlement (2). Although other properties were owned by family farmers, they were acquisitions or inherited in family succession processes.

The distribution of properties, i.e., the agglomeration of establishments in the vicinity of Cáceres County (11 of them within a radius of less than 30 km) is attributed to the ease of family farmers in trading (consumer market) green maize, as well as other products and by-products in the city.

The territorial extension of 54% of the investigated properties was equals to, or smaller than, 10ha - 15% of them ranged from 21ha to 30ha or were bigger than 40 ha, and 8% of them were represented by areas ranging from 11ha to 20 ha, and from 31ha to 40 ha. Based on the comparison between the herein collected data and those of the 2006 Agricultural Census (IBGE, 2009), the territorial extension of approximately 62% of the investigated properties was below the national average (19ha); 14% of rural properties in Mato Grosso State have area smaller than 10 ha.

Based on the current research, 92% of family properties have rural electrification; however, 8% of them do not count on this fundamental resource for the agricultural activity or to provide quality of life to family farmers. The explanation, or attempt of explanation, for this issue, is that these properties derived from occupations (illegal and/or disorganized) on the margins of BR 17.

Water in 54% of the investigated properties derives from semi-artesian or artisanal wells; 15% of these properties have water from wells and weirs; 8%, only from weirs; 15%, from streams; and 8% do not have water in it; however, they use water resources available in neighbor properties. None of the respondents had water use permit, or subjected the water in their properties to analysis in order to prove its quality; these data do not significantly differ from those found by Scheuer et al. (2018).

Only 38% of family farmers reported to have Permanent Preservation Areas (PPA) and Legal Reserves (LR), whereas 62% reported the non-existence of them, or that they had not yet managed to regularize their property's situation (Rural Environmental Registry). Thus, it is necessary guiding (technical support) and inspecting (mainly, providing instructions) family farmers to enable the environmental regulation of their properties.

According to Santana et al. (2013), lack of knowledge/individual training and inefficient Technical Assistance and Rural Extension (TARE) services have led to agricultural practices capable of affecting agroecosystems, as well as have hindered family farmers' compliance with the environmental legislation. TARE's fragility makes families hostage of their own deficiency, mainly when it comes to sustainable rural development.

Consequently, as traditionally observed in family farming, production systems investigated in the study sites, in Cáceres County, are diversified through the culture of different crops (mainly fruits and vegetables), such as green maize, and small-, medium- and large-sized animal husbandry.

Several crops were observed in the visited properties, such as fruits (lemon, banana, pineapple, papaya, orange and conifer cone - 27%), fruit vegetables (tomato, pepper, okra, cucumber, watermelon, melon and pumpkin - 23%), root vegetables (sweet potatoes and cassava - 23%), leafy vegetables (lettuce, arugula, kale, among others - 18%) and sugarcane crops (9%).

Besides agricultural production, cattle, poultry and pigs were bred in 47% of Cáceres' properties; poultry and/or swine production, in 15% of them; and cattle, in 8% of them. These results were similar to reports by Moura and Silva (2012) who ranked more than one animal husbandry type for family establishments. Fifteen percent (15%) of the investigated properties did not breed animals.

Featuring the green maize production system

Green maize culture in Cáceres County has been part of the routine of 39% of family farmers for less than 10 years; of 15% of family farmers, for 11-20 years; and of 23% of them, for 21-30 or for more than 30 years. Thus, 62% of family farmers grow maize only to be traded/consumed green; 23% grow it for harvesting purposes, both green and dry (grains); and 15% grow dry maize as their main activity, whereas green maize comes in second place.

Green maize is traded *in natura* in individual ears (69%) and/or in simple boxes/packaging (31%), in rural producers' fairs in the county (46% - relevance of this trading instance - NESPOLI et al., 2015), as well as in local supermarkets (38%), both for short commercial chains (PETERSEN, 2009) and middlemen (16%). The current study did not observe product processing among participants.

Fifteen percent of farmers have reported not to use industrial or synthetic inputs to produce green maize, i.e., they grow it organically; however, 85% often adopt the conventional cultivation system and depend on some inorganic-origin input. According to Melo et al. (2012), the hard time producing organic green maize is associated with lack of both acknowledgement and marketing standards for the segment; with low technological level (MATOS et al., 2017) adopted for its production (technology affects yield and costs - Rodrigues et al., 2018), which devalues the product when it is compared to the conventional one; as well as with excessively bureaucratic certification policies. Organic agriculture values the family labor force, as well as ensures health and environmental protection to it in, and out, of the property - these factors are seen as sustainable development requirements.

In total, 77% of farmers who grow green maize in a conventional way reported to have used the crop rotation technique (often with pastures and vegetables); 15% of them worked with intercropping; and 8% used green manure. These practices play key role in soil optimization and conservation processes (soil quality - CASTRO; DEVIDE, 2015).

Thirty-six percent (36%) of farmers adopted chemical fertilization at planting and cover time; 50% only adopted cover fertilization; and 14% did not use chemical fertilization, at all. None of those who adopted chemical fertilization were able to specify the applied dose, neither at planting, nor at cover time. This issue results from lack of instruction and technical monitoring at the properties.

As for soil management and fertilization, 46% of participants did not carry out soil analysis in planted areas; 38% rarely did it; and 16% of respondents subjected soil samples to analysis on a yearly basis. Farmers who did not monitor the quality of the soil used the argument of lack of technical follow-up to collect samples and to send them to analysis, mainly to enable agronomic interpretation and recommendation.

Respondents reported to use certified seeds acquired in agricultural shops. Purchased seeds are often stored in cabinets, or shelves, in sheds or in bins (69%). In some cases, farmers only buy what they are going to use during the crop year in question (31%).

Seventy-seven percent (77%) of respondents performed manual maize sowing (rattle) and 23% of them used mechanical sowing machines. In total, 69% of farmers preferred the rainy season to grow maize (from October to March), and 31% of them grew green maize throughout the year. It happened because some interviewees have irrigation system (regardless of technology), whose water mainly comes from streams, weirs and artesian wells.

Sixty-two percent (62%) of family farmers did not have access to technical assistance in the field (which is fundamental for rural development - REBOLLAR et al., 2010), 23% of them sought

technical assistance in agricultural shops; and 15% were assisted by government agencies, such as the Mato Grosso Research, Assistance and Rural Extension Company.

Incipient technical assistance hinders the potential of family farmers to maintain the agrarian space, mainly after the agricultural modernization taking place in the Brazilian scenario, - small family production units have been marginalized from access to public policies (MESQUITA; MENDES, 2012). It is worth keeping in mind that government programs associated with fostering and technical assistance boost the management capacity of, and income generation in, rural family properties (SCHEUER et al. 2016).

According to Lemes and Bresciane (2010), farmers' reports have evidenced lack of guidance from agricultural agencies or specialized technical assistance in Juína County, Mato Grosso State. Thus, they could only rely on empirical knowledge passed on from generation to generation and from the practice of the agricultural activity, itself.

Family farmers reported to have used pesticides to control pests and weeds; the minority of them used pesticides just in case of diseases (Table 2).

Table 2: Pesticide using, application methodology and precautions taken by green maize producers at pesticide application and packaging disposal time, in Cáceres County.

Pesticide using and equipment adopted at application time	Fa	Fr
Knapsack sprayer	9	68
Tractor sprayer	2	16
Do not use it	2	16
Total	13	100
Use of Personal Protection Equipment (PPE)		
Do not use it or not applicable	8	62
Just the mask	5	38
Total	13	100
Discard packages at collection points		
Yes	5	38
No	8	62
Total	13	100

Source: Field research (2014).

Knapsack sprayer is the application means mostly used by family farmers; applications are mainly carried out early in the day. Respondents reported to have used simple masks, among all PPEs, at pesticide application time, a fact that further exposed them to risky situations. Pesticides were stored on shelves, in sheds or in bins, and farmers did not often triple-wash the used packages, which were burnt or buried in the property.

Phytopathological control by chemical means is strongly questioned by public opinion due to demand for food products free from residues capable of harming human health and the environment. However, it is necessary having technical-scientific knowledge to use pesticides in a proper manner, in association with other phytopathological control measures defined in integrated management strategies, in order to enable diagnosing the impacts of such a use and to allow farmers to be properly assisted and guided by specialized professionals to help mitigating the risks posed by the agricultural activity (FILGUEIRA, 2003) to human and environmental health.

According to Silva et al. (2001), the inappropriate use of pesticides and lack of personal protection equipment are associated with farmers' cultural and social matters, as well as with massive weakness in technical assistance availability to rural families. The outcomes deriving from the aforementioned issues comprise intoxication of rural populations, risks to overall public health, and impacts on natural resources.

Information about the agricultural sector, mainly about green maize, is found in agricultural shops (70%), in television and internet shows (15%), or, yet, it can be informally obtained among neighbors (15%). However, 39% of novelties available are not often accessible, or even replicable, due to the need of infrastructure and qualified labor. These requirements are contrasting to respondents' low qualification and to their low access to public policies focused on rural development (PRONAF).

Deficient technical knowledge, difficulty in accessing rural credit (PRONAF) - which were previously addressed -, as well as lack of infrastructure stops the rural development of family

farming and green maize production establishment (69%). Eighty-four percent (84%) of respondents have expressed the will to improve their production system, mainly through irrigation and adequate fertilization, in order to meet the requirements set for green maize crops. Farmers' high interest in green maize is linked to its good price, wide marketing, easy management, quick financial return and crop rotation likelihood.

Final Considerations

Green maize crops have been part of the family farming culture in Caceres County for several years. Its easy handling, price, profitability and market (captive space between traders and local consumers) have enabled the establishment of green maize, despite the limitations diagnosed in rural families, properties and in the production system.

Generational succession is one the worrying factors for its production. Rural aging was detected, i.e., the age group of family farmers was close to, or in, the retirement time. Furthermore, the low reintegration of young individuals to agricultural activities, due to their migration in pursuit of better quality of life, restricts the maintenance of rural properties.

The low schooling and technical training level shown by the current respondents may have affected their heirs' decision to remain in the property, as well as the income composition of their families. Most of these individuals were raised based on the perspective of working hard to ensure their family's livelihood and of pushing schooling aside.

Essential technical assistance measures should focus on small rural establishments and on actions capable of leading to production diversification (income strategy and quality of natural resources) by taking into consideration respondents' limited land area, sustainable production (agroecological, organic, transition, among others), natural resources' regeneration capacity, agronomic recommendations (soil management and conservation, fertilization, soil analysis, cultural treatments, agricultural defensives, irrigation, among others) and rural infrastructure optimization (rural agro-industrialization, for example).

Furthermore, training and assistance models cannot be limited to the agricultural context, i.e., to green maize production and yield. Formal (Youth and Adult Education), agro-environmental (sustainable management, experience and traditional knowledge), rural management (cost control) qualification, among other public policies, would contribute to the competitive reinsertion of family farming by encouraging young individuals' permanence in their parents' rural properties, which is an auspicious path to be taken in order to enable the cultural maintenance of green maize crops and rural development, itself.

References

ABIMILHO (Associação Brasileira das Indústrias do Milho). **Consumo de milho humano e industrial do Brasil** – 2019. Available at: <<http://www.abimilho.com.br/estatisticas/consumo>>. Access on July 26, 2019.

ABRAMOVAY, R. **O Futuro das Regiões Rurais**. Porto Alegre: Ed. UFRGS, 2003, 140p.

ALMEIDA, A. C. S. et al. Caracterização de produtores e propriedades rurais em três municípios do estado de Pernambuco. **Revista Caatinga**, Mossoró, v. 19, n. 4, p. 323-332, out./dez. 2006.

BELCHIOR, E. B. et al. **Características sociais dos produtores rurais de mandioca do Assentamento Casa Branca em Cristalina, GO**. Planaltina: EMBRAPA CERRADOS, 2009. 19 p. (Documentos 271).

CARDOSO, M. J.; CARVALHO, H. W. L.; RIBEIRO, V. Q. Avaliação preliminar de cultivares de milho para produção de espiga verde em sistema agrícola familiar. **Revista Ciência Agronômica**, Fortaleza, v. 35, n. 2, p. 406-409, jul./dez. 2004.

CASTRO, C. M.; DEVIDE, A. C. P. Cultivo orgânico de milho verde consorciado com leguminosas. **Pesquisa e Tecnologia**, Campinas, v. 12, n. 1, p. 1-5, jan./jun. 2015.

COCHEV, J. S. et al. Sistemas de produção olerícola comercial do município Mato-grossense de Alta Floresta, Brasil. *Raega*, Curitiba, v. 32, p. 240-266, dez. 2014.

ESRI. *ArcGIS Desktop*: release 9.2. Redlands, CA: Environmental Systems Research Institute, 2007.

FERNANDES, T. A. G.; LIMA, J. E. Uso de análise multivariada para identificação de sistemas de produção. *Pesquisa Agropecuária Brasileira*, Brasília, DF, v. 26, n. 10, p.1823-1836, 1991.

FILGUEIRA, F. A. R. **Novo manual de olericultura**: agrotecnologia moderna na produção e comercialização de hortaliças. 2. ed. Viçosa: UFV, 2003. 412 p.

FRANÇA, C. G. et al. O censo agropecuário 2006 e a agricultura familiar no Brasil. Brasília: MDA, 2009.

GARBACCIO, J. L. et al. Envelhecimento e qualidade de vida de idosos residentes da zona rural. *Revista Brasileira de Enfermagem*, Brasília, DF, v. 71, n. 2, p. 724-732, 2018.

GOODMAN, L. A. Snowball Sampling. *Annals of Mathematical Statistics*, Beachwood, v. 32, n. 1, p. 148-170, 1961.

HOFFMANN, R. A agricultura familiar produz 70% dos alimentos consumidos no Brasil? *Segurança Alimentar e Nutricional*, Campinas, v. 21, n. 1, p. 417-421, jan./jun. 2014.

IBGE (Instituto Brasileiro de Geografia e Estatística). **Censo Agropecuário 2006**, resultados preliminares. Rio de Janeiro: IBGE, 2009. Available at: <http://www.ibge.gov.br/home/estatistica/economia/agropecuaria/censoagro/brasil_2006/Brasil_censoagro2006.pdf>. Access on June 24, 2019.

IBGE (Instituto Brasileiro de Geografia e Estatística). **Mato Grosso/Cáceres**. Rio de Janeiro: IBGE, 2019. Available at: <<http://www.cidades.ibge.gov.br/xtras/perfil.php?lang=&codmun=510250&search=mato-grosso|caceres>>. Access on January 15, 2019a.

IBGE (Instituto Brasileiro de Geografia e Estatística). **Mato-Grosso/Caceres/Infograficos**. Rio de Janeiro: IBGE, 2019. Available at: <<http://cod.ibge.gov.br/44T>>. Access on June 05, 2019b.

IBGE (Instituto Brasileiro de Geografia e Estatística). **Sistema IBGE de recuperação automática – SIDRA**. Rio de Janeiro: IBGE, 2019. Available at: <<http://www.sidra.ibge.gov.br/bda/tabela/protabl1.asp?c=73&z=p&o=26&i=P>>. Access on July 25, 2019c.

LEMES, D. P.; BRESCIANI, D. G. A agricultura familiar no município de Juína: uma análise de caso dos produtores da APROFEJU. *Revista Científica da AJES*, Juína, v. 1, n. 2, p. 1-15, set./dez. 2010.

MATOS, D. J. C.; SOUZA, R. F.; BORGES, A. P. C. Desenvolvimento e produção de milho verde sob doses de ureia em cobertura. In: IV CONGRESSO INTERDISCIPLINAR - RESPONSABILIDADE, CIÊNCIA E ÉTICA, 4. 2017, Goiânia-GO. *Anais...* Goiânia: FACEG, 2017. Available at: <<http://anais.unievangelica.edu.br/index.php/cifaeg/article/view/804>>. Access on July 26, 2019.

MATOS, M. J. L. F. et al. **Milho verde**. Brasília: EMBRAPA HORTALIÇAS, 2007. Available at: <http://www.cnph.embrapa.br/laborato/pos_colheita/dicas/milho_verde.htm>. Access on June 03, 2018.

MELO, K. C. et al. Análise socioeconômica e ambiental dos produtores familiares do município de Juína/MT e suas dificuldades. In: XXI ENCONTRO NACIONAL DE GEOGRAFIA AGRÁRIA, 21.,

2012, Uberlândia-MG. **Anais...** Uberlândia: UFU, 2012. Available at: <http://www.lagea.ig.ufu.br/xx1enga/anais_enga_2012/eixos/1067_1.pdf>. Access on May 25, 2019.

MESQUITA, L. A. P.; MENDES, E. P. P. Agricultura familiar, trabalho e estratégias: a participação feminina na reprodução socioeconômica e cultural. **Espaço em Revista**, Catalão, v. 14, n. 1, p. 14-23, jan./jun. 2012.

MICROSOFT. **Microsoft Excel**: versão 2016. Washington, DC: Microsoft Corporation, 2016.

MOURA, A. M. P.; SILVA, G. M. G. Agricultura familiar: perspectivas de permanência dos jovens no campo do município de Igaci/Alagoas. In: ENCONTRO NACIONAL DE GEOGRAFIA AGRÁRIA, 21., 2012, Uberlândia-MG. **Anais...** Uberlândia: UFU, 2012. Available at: <http://www.lagea.ig.ufu.br/xx1enga/anais_enga_2012/eixos/1092_1.pdf>. Access on May 26, 2019.

NESPOLI, A.; COCHEV, J. S.; NEVES, S. M. A. S.; SEABRA JÚNIOR S. Produção de hortaliças pela agricultura familiar de alta floresta, Amazônia Matogrossense. **Campo-Território**: revista de geografia agrária, Uberlândia, v. 10, n. 21, p. 159-191, ago, 2015.

NEVES, S. A. S. M.; NUNES, M. C. M.; NEVES, R. J. Caracterização das condições climáticas de Cáceres/MT/Brasil, no período de 1971 a 2009: subsídio às atividades agropecuárias e turísticas municipais. **Boletim Goiano de Geografia**, Goiânia, v. 31, n. 2, p. 55-68, jul./dez. 2011.

PEREIRA FILHO, I. A. et al. **Árvore do conhecimento**: milho verde. Available at: <<https://www.agencia.cnptia.embrapa.br/gestor/milho/arvore/CONT000fy779fnk02wx5ok0pvo4k3c1v9rbg.html>>. Access on July 26, 2019.

PETERSEN, P. (Org.). **Agricultura familiar camponesa na construção do futuro**. Rio de Janeiro: AS-PTA, 2009. 168 p.

PNUD (Programa das Nações Unidas para o Desenvolvimento, Brasil). **Atlas do Desenvolvimento Humano no Brasil 2013 – Rankig 2010**. Brasília, DF: 2013. Available at <<http://www.atlasbrasil.org.br/2013/pt/ranking>>. Access on July 27, 2019.

RANKBRASIL. RankBrasil Recordes Brasileiros. **Maior pamonha do Brasil**, 2011. Available at: <http://www.rankbrasil.com.br/Recordes/Materias/0egZ/Maior_Pamonha_Do_Brasil>. Access on June 14, 2017.

REBOLLAR, P. B. M.; MILLER, P. R. M.; CARMO, V. B. Desenvolvimento rural e práticas tradicionais de agricultores familiares: o caso do milho no vale do Capivari, Santa Catarina, Brasil. **Revista Brasileira de Agroecologia**, Pelotas, v. 5, n. 2, p. 174-186, jul./dez. 2010.

REGITANO-D'ARCE, M. A. B.; SPOTO, M. H. F.; CASTELLUCCI, A. C. Processamento e industrialização do milho para a alimentação humana. **Visão Agrícola**, Piracicaba, n. 13, p. 138-140, jul./dez. 2015.

RICHETTI, A. **Viabilidade econômica da cultura da soja na safra 2016/2017, em Mato Grosso do Sul**. Embrapa Agropecuária. 2016, 5p. (Comunicado técnico 211).

RODRIGUES, C. C. et al. Análise econômico-financeira da implantação do cultivo de milho verde. **Agrarian Academy**, Goiânia, v.5, n. 9, p. 19-29, jan./jun. 2018.

SANTANA, J. S. et al. Desafios dos serviços de assistência técnica e extensão rural visando o desenvolvimento sustentável das comunidades rurais do município de Cruz das Almas – BA. **Campo Jurídico**, Barreiras, v. 1, n. 2, p. 15-34, out. 2013.

SCHEUER, J. M. et al. Aspectos socioeconômicos dos agricultores familiares da associação dos pequenos produtores da região do Alto Sant'Ana, Mato Grosso. **Revista Brasileira de Gestão e Desenvolvimento Regional**, Taubaté, v. 12, n. 1, p. 85-106, jan./abr. 2016.

SCHEUER, J. M. et al. Sustentabilidade dos agricultores familiares da Associação dos Pequenos Produtores da Região do Alto Sant'ana de São José dos Quatro Marcos, Mato Grosso. **Revista Metropolitana de Sustentabilidade**, São Paulo, v. 8, n. 3, p. 122-141, set./dez. 2018.

SCHEUER, J. M.; VASSALLO, M. GRAVINA, V. Tipificação dos estabelecimentos agropecuários da agricultura familiar gaúcha de roque gonzales. *Revista Brasileira de Gestão e Desenvolvimento Regional*, Taubaté, v. 15, n. 3, p. 242-255, mai-ago, 2019.

SCHNEIDER, S. As novas formas sociais do trabalho no meio rural: a pluriatividade e as atividades rurais não agrícolas. **Redes**, Santa Cruz do Sul, v. 9, n. 3, p. 75-110, set./dez. 2004.

SIMIONI, F. J.; BINOTTO, E.; BATTISTON, J. Informação e gestão na agricultura familiar da região oeste de Santa Catarina. **Revista Brasileira de Gestão e Desenvolvimento Regional**. Taubaté, v. 11, n. 3, p. 152-177, set-dez, 2011.

SILVA, J. J. O. et al. Influência de fatores socioeconômicos na contaminação por agrotóxicos, Brasil. **Revista de Saúde Pública**, São Paulo, v. 35, n. 2, p. 130-135, abr. 2001.

SILVA, E. T.; MARTINS, D. E. C. Perfil dos produtores de produtos hidropônicos do município de Colombo Região Metropolitana de Curitiba – PR. **Revista Acadêmica: ciências agrárias e ambientais**, Curitiba, v. 2, n. 1, p. 49-59, jan./mar. 2004.

SILVA, D. O.; HESPANHOL, R. A. M. A produção Rural Familiar em Jacarezinho-PR: estratégias de produção e submissão ao capital. **Campo-Território - Revista de Geografia Agrária**, Francisco Beltrão, v. 4, n. 7, p. 185-200, fev. 2009.

SILVA, S. P. Políticas públicas, agricultura familiar e desenvolvimento territorial. **Cadernos Gestão Pública e Cidadania**, São Paulo, v. 16, n. 58, p. 126-144, jan-jun, 2011.

SIMÕES, A. C. **Caracterização dos agricultores familiares: agentes multiplicadores em assentamentos rurais da região de Andradina (SP)**. 2006. 61f. Dissertação (Mestrado em Agronomia) - Universidade Estadual Paulista Júlio de Mesquita Filho, Ilha Solteira, 2006.

SIMONETTI, D. et al. Os processos de diversificação da agricultura familiar: uma revisão literária. **Synergismus scyentifica UTFPR**, Pato Branco, v. 6, n. 1, p. 1-6, jun. 2011.

SOUZA, R. P. Indicadores de desenvolvimento rural: avanços para uma proposta de análise municipal. **Revista Brasileira de Gestão e Desenvolvimento Regional**, Talbaté, v. 15, n. 2, p. 120-128, mar, 2019.

TIGRE, P. B. Gestão da inovação: a economia da tecnologia do Brasil. Campinas, **Revista Brasileira De Inovação**, v. 5, n. 2, p. 479-785, jul-dez, 2006.

TRIOLA, M. F. **Estadística**. 9. ed. México: Pearson Educación, 2004.

TSUNECHIRO, A.; MIURA, M. Caracterização Técnico-Econômica da Cultura do Milho Verde no Brasil em 2006. In: XXIX CONGRESSO NACIONAL DE MILHO E SORGO, 29., 2012. Águas de Lindóia-SP. **Anais... Águas de Lindóia, ABMS, 2012**. Available at: <http://www.abms.org.br/29cn_milho/12699.pdf>. Access on July 13, 2018.

VAN DEN BRULE, D. M.; FERREIRA, I. H. R. D. S.; NASCIMENTO, D. C.; MACIEL, L. N. Q. Reflexões sobre o conceito de desenvolvimento de uma perspectiva multidimensional. **Revista brasileira de Desenvolvimento Regional**, Blumenal, v. 6, n. 2, p. 5-20, 2018.

WANDERLEY, M. N. B. Jovens rurais de pequenos municípios de Pernambuco: que sonhos para o futuro. In: CARNEIRO, M. J.; CASTRO, E. G. (Org.). **Juventude Rural em Perspectiva**. Rio de Janeiro: Mauad X, 2007. p. 21-34.

WELSHELMER, N. Desenvolvimento rural, capitalismo e agricultura familiar. **Olhares sociais**, Cruz das Almas, v. 2, n. 2, p. 51-78, 2013.



Esta obra está licenciada com uma Licença Creative Commons Atribuição 4.0 Internacional.