



Work division in family farm production units: Feminine responsibilities typology in a semi-arid region of Brazil



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ABSTRACT

There has been evidence indicating that women in underdeveloped (or developing) countries carry a disproportionate burden of the costs of this economic dynamics while men enjoy its benefits. These criticisms on analysis moved gender from the periphery to the center of the development debate. Brazil and particularly the state of Ceará have not yet seen any of the repercussions of the analytical advances. This study on the role of women in the agriculture of the semi-arid aims to analyze the complexity of the factors that interact in order to recognize the nature of women's participation in semi-arid world areas comparatively to other disadvantaged environments. In the semi-arid area, rural women are able to cover a broader spectrum of tasks and fuller management activities when compared to other disadvantaged areas of the world. They cover all rural management activities. Besides, rural women's work is predominantly more complex when compared to men's work in semi-arid regions worldwide. Their greater ability to perform these activities is because these women combine different strategies in an efficient and dynamic way, adapting themselves to the demands of labor and the natural semi-arid environment.

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1. Introduction

A number of studies have been carried out in the last two decades concerning disadvantaged and ecologically vulnerable regions using typologies to understand, among other things, the relationship between technical management variables and the work factor (Gibon et al., 1995; Kobrich et al., 2003; Paz et al., 2008; Usai et al., 2006). In Brazil two studies applying classification systems to rural areas stand out: (i) the first, conducted by the UN through a FAO agreement with INCRA [National Institute for Colonization and Agrarian Reform] (INCRA/FAO, 2000), focused on the availability of family work; (ii) the second, the Rurbano Project, carried out by the University of Campinas (Unicamp, São Paulo), was based on micro-data from the PNAD [Brazilian National Household Sample Survey] – 1992 to 1999 and 2001 (Del Grossi et al., 2002). These studies continue to serve as reference points for decision-making at public and private levels, although the classifications they use are not based on multifactorial statistical methodology. Moreover, though

they incorporate poverty and social inequality measurements, they do not specifically refer to female rural labor.

In the Brazilian Northeast, a region considered economically and ecologically vulnerable, there are very few studies that incorporate both the work factor and management indicators using multifactorial statistics (IBRD, 1975; Souza-Neto et al., 2004; de Almeida, 2004). The classification systems used do not distinguish component variables relating specifically to female labor. These typologies are based on a conventional economic rationality: the labor of the property owner, generally a man, is emphasized to a larger degree, whereas that of the rest of the family is classified as “help”. Women's labor is included in this “help”, pre-supposing that the responsibility for the management of the production unit is essentially from the male. An exception is the typology produced by Kobrich et al. (2003) in Chile, where the authors incorporated a specific variable of family work, “number of months a woman spends working within the productive unit”. As to Brazilian research we assume that these typologies were produced in a period when the main objectives of agricultural policy were related to production and to the economy. However, since the beginning of the Lula's presidency (2003–2010), the objectives of agricultural policy have been considerably expanded, encompassing issues relating to the environment and to the viability of rural life of non-

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elite sectors. To achieve this, the Ministry of Agrarian Development (MDA) established technical assistance programs under the 'New National Policy of Technical Assistance and Rural Expansion' plan – PNATER – (Brazil-MDA, 2004). This plan was adapted to different territories and regional realities and took into account the recognition of diversity and specificities of gender and ethnicity. In view of these changes in the MDA policy, the typologies used for rural families need to be improved as an instrument with which to analyze and to monitor rural development without ignoring female participation in the formation of wealth. This entails observations on how to improve the productivity of agriculture and cattle farming, observations that were once exclusively directed towards men, despite the key role that women played in the production of food and trade in many peripheral countries (Noble, 1992). Furthermore, there has been mounting evidence that women in underdeveloped (or developing) countries carry a disproportionate burden of the costs of economic development while men enjoy its benefits (Beneria, 1981; Boserup, 1970; Buvenic and Youssef, 1980; Nelson, 1981). In part, due to the traditional gendered division of labor in agriculture, many development projects have further increased the burden on female labor, particularly in Sub-Saharan Africa (Noble, 1992).

These observations and criticisms on development plans moved gender from the periphery to the center of the development debate (Goddard, 1985) and provided greater economic and political support to programs and research specifically related to women in peripheral countries. Overcoming gender disparities at the political-economic level in both rural and urban environments is now a UN (2000) objective to be achieved world-wide by 2015. But, as usual, the world of rural women continues to attract little interest from other social and economic sectors. Traditional gender division conceals the size of women's economic participation in the formation of rural wealth and its consequent development. Female labor has been underestimated in the agrarian sector because it is not considered as primary and women are not commonly paid to produce food for consumption and trade in Family Units (FAO, 1996–2001). However, in periphery capitalist countries the economic position of rural women for many decades has been associated with their role in food production and preparation (World Bank, 1980, 2000). It is intrinsically associated with the nutrition and food security of poor populations (Pinstrup-Andersen and Marito, 1984). Many authors have shown (Benevides, 2004; Rua et al., 2000; Shalander, 2008; Vidal, 1995a,b; Vidal and Alencar, 2009; among others) what the involvement of rural women in farming production has meant to the development of this region, and therefore, of the country. Despite a certain growth in the awareness of gender issues around the world, systematic data on the work done by rural women and their contribution to the development of local economies is rare.

Brazil, and particularly the state of Ceará have not yet seen any of the repercussions of the analytical advances which took place during this decade. In Ceará, there have not been typological studies with or without the use of advanced statistics about the specific participation of women in the technical management of rural productive activities. Therefore, this is a fertile and challenging field for research.

This study, focused on the role of women in the agriculture of the semi-arid *Sertões* of Ceará, aims to analyze the complexity of the factors which interact in order to recognize the nature of women's participation in work within the micro-economy, bringing together the problematic of the feminization of poverty in Brazil (Brazilian Federal Chamber, 2004), and the economic and social investment in the value of family and peasant work in Lula's administration. Thus, this work seeks to characterize the diversity

of female work in the farming management of rural production. It offers approaches to recognize and to empower rural women regarding their participation in the formation of wealth in semi-arid world areas. The objectives of the current study were: (i) to describe the general sociological characteristics and to compare the more relevant rural work carried out by women in different communities in a Brazilian semi-arid region, (ii) to identify the explicative statistical components of the most important female activities and to establish typological groups of women according to the incidence of female work in that region, (iii) to compare the incidence and diversity of semi-arid women's most important activities with those in other disadvantaged world environments, and (iv) to identify what activities are prevalent among women in semi-arid rural regions of the world.

2. Methodology

2.1. Study area

The *Sertão* region in the Brazilian Northeast is characterized by marginal and threatened eco-systems, a great diversity of semi-arid landscapes and traditional customs. Its history, marked by *latifundia* (large estates) and intense inequality which is not only economic, lays bare the existing prejudice in relation to activities performed by women.

In the *Sertão*, drought together with the system of *latifundia* and gender discrimination have had an enormous impact, affecting mainly the rural poor and, more directly, women. In the Northeastern state of Ceará, in particular, this issue assumes strategic character, as a reduction was observed in the percentage of women living in rural areas of the interior, including the extensive *Sertão* areas (IPECE, 2008).

This study took place in the District of *Baixo Trici*, located in the Tauá Municipality, Inhamuns *Sertão*, State of Ceará, Brazil (Fig. 1). The Municipality of Tauá started to develop in 1762 in the Trici river valley, which forms the Alto Jaguaribe river basin. The municipality has a total area of 4017.19 km² and is located at an altitude of 402.7 m. It has an estimated population of 52,398 of which 52% live in rural areas (IPECE, 2009). The predominant climate is warm semi-arid tropical, with a mean annual rainfall of 597.2 mm which is concentrated in the period February–April and a mean annual temperature of 28 °C. The vegetation is made up of tropical xerophytic deciduous broadleaf scrub, known as Open Shrub *Caatinga* (FUNCEME, 2009). Economic activities of the rural communities relate primarily to the production of cows' milk and cheese and vegetables gardens and secondly to the production of meat from small ruminants (Araújo et al., 2008).

2.2. Data collection

Original and *in situ* data collection was carried out using semi-structured interviews of 75 women from six different rural communities of the District of Baixo Trici, namely: Junco ($n = 16$), Tapera ($n = 16$), Lustal 1 ($n = 16$), Lustal 2 ($n = 9$), Tiassol ($n = 9$) and Queimadas ($n = 9$). The number (n) of women per community is different because it depended upon voluntary participation in this study. However, these differences preserved the women representation in all the communities. The current study encompassed 24.59% of rural women in these communities (Table 1). These women represented Family Farm Production Units (FPUs) in the project entitled the "Economic and social self-maintenance of rural communities through naturalized dairy goats in the semi-arid region of Inhamuns, Ce", funded by the CNPq [Brazilian National Council for Scientific and Technological Development], (Edict n°19/05).

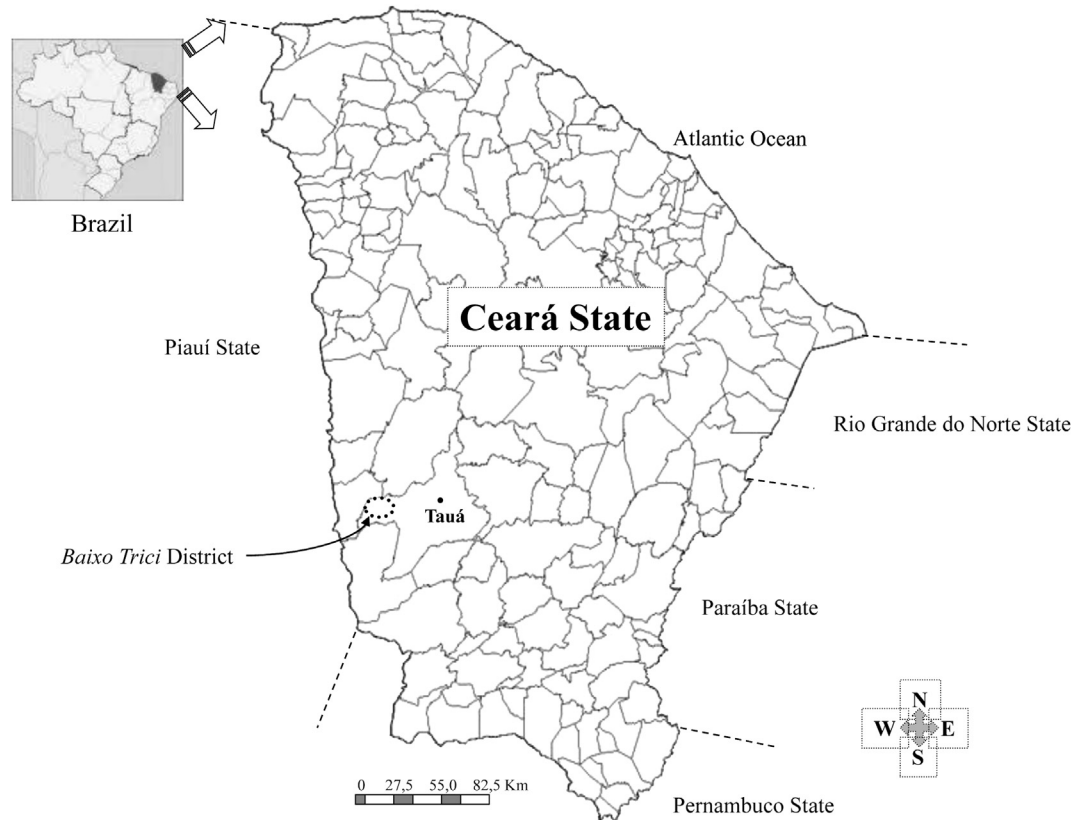


Fig. 1. Study area in Ceará State.

The following information was obtained from each woman: (i) general sociological characteristics: age (in years), education (informal education, primary, secondary, higher education) and family phase (no children, pre-school age children, school age children, children over 16-year-old); (ii) agricultural responsibilities (that is, crop production – *roçado*); (iii) animal rearing responsibilities (including cow, goat, sheep, fowl and swine); (iv) vegetable garden and orchard extraction responsibilities; (v) responsibilities related to FPU management and administration tasks, that is, other work.

Questionnaires were conducted from March to October 2008 by the LESISA (Semi-arid Systems Research Laboratory) team, State University of Ceará (UECE), Brazil.

2.3. Data analysis

A Principal Components Multivariate Analysis (PCA) with Varimax Rotation and Euclidean Distance (Parameters: Alpha = 0.5;

Beta = 0.5 and Gama = 0.9) (Hair et al., 2006) was conducted to identify statistical components which explain the main agricultural, animal rearing work and/or management carried out exclusively by rural women or in cooperation with another family member and/or paid worker. Initially, for the set of women in each rural community a descriptive analysis of the division of tasks in the FPU was conducted. The descriptive analysis included calculation of the frequency (Daniels, 1984) of each of the criteria above. Subsequently, a comparison of criteria in each community was conducted using ANOVA for quantitative variables, and Contingency Tables and Chi-squared test for qualitative variables.

The identification of explicative statistical components of heterogeneity using a Principal Component Analysis allowed focal variables to be defined (Table 2), and these were analyzed according to their incidence in respective classes (Table 3). The geometric coordinates of PCA components were the basis of a subsequent Cluster Analysis (Daniels, 1984). This procedure allowed us to differentiate and characterize women in groups (G) in accordance with their type of work in farming management. The

Table 1
Sample size and distribution of rural women according to community.

Communities <i>Baixo Trici</i> district	Women in FPU ^b studied (n ^o)	Sample women by community in this study (%)
Junco	16	20.00
Lustal 1	16	26.67
Lustal 2	9	18.00
Queimadas	9	28.13
Tapera	16	30.19
Tiassol	9	30.00
Total	75	χ^a 24.59

^a Mean.

^b FPU: familiar production unit.

Table 2

Identification of the main statistical factors explaining the heterogeneity of high frequency tasks relating to fowl, swine and vegetable gardens-orchards.

	Factor 1	Factor 2	Factor 3
Fowl nourishment	-0.005	0.026	0.557
Fowl hygiene	-0.022	0.062	0.565
Fowl care	-0.015	0.059	0.564
Swine reproduction	0.140	0.484	-0.064
Swine hygiene	0.125	0.495	-0.032
Swine care	0.125	0.495	-0.032
Orchard-vegetable garden cleanness	-0.355	0.132	0.018
Orchard-vegetable garden seeding	-0.361	0.090	0.037
Orchard-vegetable garden manual irrigation	-0.339	0.100	-0.024

Table 3
Focal and other rural management variables and their respective classes.

Focal variables	
Rural management ^a	Classes ^b
Fowl	Woman, woman + relatives, family.
Swine	Woman, woman + husband, family.
Vegetable garden-orchard	Woman, woman + daughters, woman + husband, family, absent.
Other variables	
Rural management ^a	Classes ^b
Goats	Family, children, husband, husband + son, Woman + husband, husband + wage-earning worker, absent.
Sheep	Family, children, husband, husband + wage-earning worker, Woman + husband, absent.
Cows	Family, husband, husband + woman, children. Husband + wage earning worker, absent.
Roçado	Family, husband, family + wage-earning worker, husband + associative work, husband + wage-earning worker. Husband + woman + wage-earning worker.
Other work	Family, woman, woman + husband, husband. Woman + relatives, husband + woman.

^a Dominant range.

^b When there are associations between different manpower classes to the first person that appears in the association will be more responsibility for the task.

number of groups was established based on the Unweighted pair-group method of the Euclidean distance and standard deviation scale type.

The resultant typology was used to analyze the diversity of female work contribution to the management of FPU. Even so, for the groups formed, as well as the focal variables used, other variables relative to the management of ruminants, *roçado* and other types of work were calculated (Table 3), and also variables relative to the availability of productive factors and age of women (Table 4).

Finally, focal and other variables were submitted to an Analysis of Variance, a criterion associated to Fisher and Bonferroni tests. The Chi-squared analysis was used for qualitative variables, namely: participation in the management of fowl, swine and ruminants rearing, orchards and vegetable gardens, other work, age of the women, facilities, silos, tractors, foraging machines and other machines. All statistical analyses were conducted using the BioEstat 5.0 Program.

3. Results and discussion

3.1. Sociological aspects

Eighty-nine percent of rural women ($n = 67$) did not have any access to formal education. These results corroborate the empirical

Table 4
Other variables on productive factors and age of woman and their respective classes.

Availability of productive factors	
Quantitative variables	Description
Productive factors	
Family AWU(%)	Percentage of family annual work units in relation to total annual work units
UAA(ha)	Utilized agricultural area
Qualitative variables	
Productive factors	
Facilities ^a	Low (=1), intermediate (>1 ≤ 3) or high (>3)
Silos	Single type ^b , combined or absent
Tractors	Community owned, hired or absent
Forage machines	Available or absent
Other machines ^c	Available or absent
Sociological	
Age of woman	≤40 years; ≥40 < 50years; >50 years

^a It express the availability.

^b Tower or horizontal type.

^c Mower, motor-pump and/or shredder.

results obtained for a large number of Arab and Sub-Saharan African Countries ($n = 40$) and indicate that gender inequalities had a strong and significant statistical effect on female literacy (Balioune-Lutz and McGillivray, 2009). Of the remainder, few started or finished primary, secondary or higher education (6.67%; 5.33% and 5.33%, respectively in relation to the total number ($n = 75$), $p < 0.0001$). This evidence corroborates the findings of Fisher et al. (2003) for rural women in the state of Pernambuco, and of Benevides (2004) for the state of Bahia, both in the Brazilian semi-arid region.

The majority of women in the study ($n = 50$) are on average younger than 45.52-years old and reside in the communities of Tapera, Lustral 1, Lustral 2 and Queimadas. However, differences in average age between communities were not significant.

Nelson (1968) was the first to identify family phases with regard to the availability of manpower. Family is classified according to the age of children throughout their lives. In the communities of Lustral 2 and Tapera, families are predominantly in Phase 2, that is, recently formed with children of pre-school age or younger than 6-year-old ($p < 0.0001$). The exception is Queimadas with intermediate to high ($p = 0.4215$) percentages of informal education for women. In the communities of Lustral 1 and Queimadas a balance between the distribution of family phases is observed, significant only for the former ($p < 0.0001$). In the remaining communities, Junco and Tiassol, similarities with regard to the respective average age of rural women (51.25 and 51.44-year-old) are observed and also with regard to the fact that their children were already incorporated in the employment market. However, the respective percentages of informal education of women in these communities are diametrically opposite, as in Junco they are the highest (93.75%) and in Tiassol they are the lowest (55.56%).

There is general consensus about the positive correlation between education and economic growth (Schultz, 1994). These results are probably associated, therefore, to the fact that in the community of Tiassol, contrary to what happens in Junco, there is evidence of greater economic dynamism. This is linked to social relations of production which incorporates paid labor in higher numbers (Vidal, 2009; Vidal and Alencar, 2009), breaking down the link between the farming activities of rural women and possibly allowing them to improve their education, as formal education of women is envisaged as a way for them to achieve autonomy and control over their lives (Basu, 2002).

In effect, it is in this community (Tiassol) where we can find greater diversity in the level of female education: 55.56% Informal Education, 22.22% Incomplete Primary Education, 11.11% Incomplete Higher Education and 11.11% Completed Higher Education ($p < 0.0001$). This trend, evident in the Inhamuns semi-arid, has been noted in European literature for decades (Arnalte-Alegre, 1980; for Spanish women; Haugen, 1990; for women in Norway and Shucksmith and Smith, 1991; for women in Scotland, among others). Furthermore, a greater number of literate women is associated with an increase in the feminization of the non-rural workforce – a classic tendency flagged by authors in Europe since the 1960s (Barberis, 1963 for Italy and Rodrigo, 1986 for Portugal, among others), and now demonstrated for rural women in the Sertão of Inhamuns (Ceará).

3.2. Responsibilities for orchards-vegetable gardens and animal production

With regard to fowl management, at the level of the communities analyzed, the participation of women stood out, since it appeared as an important female activity. In five communities, with the exception of Junco ($p < 0.0001$), they were responsible for it, either alone or in collaboration (Table 5). These results are

Table 5
Female participation with fowl, swine, vegetable gardens-orchards, *roçado* (cultivation), other work and ruminant cattle management by community.

Management	Woman (%)	Rural communities*						Total
		Lustal 1	Lustal 2	Tiassol	Queimadas	Tapera	Junco	
Fowl ^a	Uniquely responsible	22.22	8.89	11.11	15.56	17.78	24.44	100
	Collaborator	25.00	25.00	5.00	5.00	40.00	0.00	100
	Absent	10.00	0.00	30.00	10.00	0.00	50.00	100
Swine ^b	Uniquely responsible	35.29	11.76	0.00	23.53	11.76	17.65	100
	Collaborator	9.09	15.15	9.09	9.09	18.18	39.39	100
	Absent	28.00	8.00	24.00	8.00	32.00	0.00	100
Vegetable Garden-orchard ^c	Uniquely responsible	21.21	15.15	0.00	3.03	30.30	30.30	100
	Collaborator	7.14	0.00	0.00	7.14	42.86	42.86	100
	Absent	28.57	14.29	32.14	25.00	0.00	0.00	100
Other work ^d	Uniquely responsible	0.00	100.00	0.00	0.00	0.00	0.00	100
	Collaborator	22.03	13.56	15.25	13.56	22.03	13.56	100
	Absent	21.43	0.00	0.00	0.00	21.43	57.14	100
<i>Roçado</i> ^e	Collaborator	21.43	2.38	4.76	16.67	16.67	38.10	100
	Absent	21.21	24.24	21.21	6.06	27.27	0.00	100
	Collaborator	5.26	21.05	10.53	36.84	21.05	5.26	100
Goats ^f	Absent	26.79	8.93	12.50	3.57	21.43	26.79	100
	Collaborator	13.89	5.56	0.00	22.22	33.33	25.00	100
	Absent	28.21	17.95	23.08	2.56	10.26	17.95	100
Cows ^f	Collaborator	20.00	16.00	0.00	20.00	8.00	36.00	100
	Absent	22.00	10.00	18.00	8.00	28.00	14.00	100

* $p < 0.0001$.

^a Sub-tasks: cleaning and placement of the troughs and water containers, supply of concentrates, forage and water; monitoring of sick and disabled animals and manure removal from the facilities.

^b Sub-tasks: cleaning and placement of the troughs and water containers, supply of concentrates, forage and water; breeding and delivery seasons monitoring, sick and disabled animals monitoring and manure removal from the facilities.

^c Sub-tasks: mechanical irrigation, manual or mechanical fertilization, mechanical or manual application of pesticides and harvest of fruits.

^d Sub-tasks: administrative jobs (letters, forms, payments and phone service), accounting courses in rural areas for Family Production Units, selling products to consumers in markets or cooperative and household chores for employees of Family Production Units.

^e Sub-tasks: land preparation and plant care.

^f Sub-tasks for ruminants: cleaning and placing of containers for fodder and water, collection and cutting of fodder; tracking breeding seasons, calving, sick and disabled animals; supply of concentrates, roughage, mineral and water; removal and placement of animals in the pen and manure removal facilities.

consistent with those presented in a field study conducted to investigate the system of production and the use of domestic fowl by rural women in the semi-arid region of Bangladesh (Rahaman, 2003). While the husbands applied variable and smaller amounts of work to manage domestic fowl (0.49 Annual Work Units – male AWU), rural women were the most responsible for activities associated with fowl, resulting in differences in labor (1.49 female AWU) (Rahaman, 2003). However, in other studies carried out in Bangladesh (Beg et al., 1994; Islam, 1985), a similar distribution in work factor was reported with regard to fowl management, for rural men and women.

The participation of women in Ceará's semi-arid rural communities with regard to swine management was relevant, as they are totally responsible and/or collaborators in this economic branch in five communities with the exception of Tiassol ($p < 0.0001$) (Table 5). Similar findings were reported by other authors in Asian regions, such as New Guinea or India. In effect, the daily work of managing swine was extensively observed as being a female responsibility in these regions, whereas men took on responsibility or predominated in public transactions linked to swine rearing (Boyd, 2001). Furthermore, recent results from a project to reduce poverty through animal farming in India (ILRI-International Livestock Research Institute, 2008) showed that in the desert region of Andhra Pradesh, swine rearing stood out as the most important activity in extremely poor rural communities.

In these communities rural women, despite taking on important responsibilities regarding these animals, represented slightly more than 18% of owners of Rural Units, and as a consequence did not manage links with public life. Some authors interpret this labor arrangement as exploitative since the women look after the swine while men use this labor in the public arena, which characterizes these relations as unequal and discriminatory towards female

activities (Josephides, 1985). This could be a patriarchal strategy through which men guarantee the perpetuation of their position as decision-makers in issues relating to the formal economy, thus facilitating the indirect appropriation of more consistent material means (McCusker and Carr, 2006).

In Tapera, Junco, Lustal 1 and Lustal 2, women had a high level of participation in vegetable garden cultivation and orchard extraction. There are exceptions in Tiassol and Queimadas, as in the first locality they do not cultivate orchards-vegetable gardens, and in the second female participation, where participation as unique responsible and/or in collaboration, is low ($p < 0.0001$) (Table 5). In the FPU of the former communities the most common vegetables cultivated were parsley (*Petroselinum crispum*), chives (*Allium fistulosum*) and lettuce (*Lactuca sativa*) and the main fruit were melons (*Citrullus lanatus*), mangos (*Mangifera indica*) and guavas (*Psidium guajava*). Vegetables produced and/or collected were periodically sent for direct sale in municipal markets which occur once a week. It is worth noting that of the many tasks related to the orchards-vegetable gardens, women worked specifically with mechanical irrigation, manual or mechanical fertilization, manual or mechanical application of pesticides and the harvesting of fruit, vegetables, legumes and tubers. However, they do not perform the tasks of sowing, manual irrigation, manual cleaning of weeds and aphid control, considering results found in the PCA for the first component (39.49% of variance) (Table 2).

For these activities, women themselves, supported by other family members, directly traded the fruit of their labor. These results are consistent with findings by authors working in other semi-arid regions. For example Frankenberger et al. (1989), analyzed family orchards-vegetable gardens in Mauritania, where this activity was performed exclusively by women in cooperatives (cultivating mainly melons, wild peas, okra and hibiscus), and

traded by the peasant women producers themselves. In another African region, Kumbija (Senegal), the impact of female labor on orchards-vegetable garden-projects in arid regions was studied by Reynaud et al. (1989). These authors observed that orchards-vegetable gardens were usually set up after the millet harvest on plots of land closest to rural houses. Women cultivated and sold their vegetables, whereas men built fences and ploughed the land. We can see that in Inhamuns, as in these African regions, the predominance of consumable vegetables from domestic sources, that is autochthonous cultivation. They are an example of the bio-regionalist aspect of fruit and vegetable growth in tropical regions associated with semi-arid climates (Longhurst, 2006). These rural female practices are associated, therefore, with the recovery and conservation of the local biodiversity and of themselves act as social and economic agents as they have been inserted into the cultural context of the semi-arid rural areas (Bullas – Ayuntamiento de Bullas, 2007). Only in Lustal 2 were rural women uniquely responsible for other work (administrative and management tasks), while in Lustal 1 and Tapera they were collaborators ($p < 0.0001$) (Table 5). These results are consistent with those of Vidal (1995a) who observed that 60.94% of peasant women belonging to family units in the River Ebro Middle Valley (Semi-arid Aragón, Spain), carried out administrative tasks.

With regard to *roçado* work and working with ruminants (goats, sheep and cattle) it was observed that in all the studied rural communities, the participation of rural women was of little relevance, and when there was participation, it was seen as collaborative work with other responsible people, namely husbands, sons and daughters, relatives and paid workers, either permanent or temporary ($p < 0.0001$) (Table 5). In Tiassol no women participated at a primary level in activities related to ruminants and in the other communities few women took on responsibilities related to goats and sheep, and cattle and sheep, respectively (Table 5). In the district of *Baixo Trici*, the production of these animals is associated with the availability of land and mainly relies on the temporary mobilization of family and a paid workforce. These results show a different trend when compared to other semi-arid or arid regions in the world. For example, in the desert region of Rajasthan (India), Kumar (2004) conducted a study in 150 FPU to evaluate the involvement of family members in working with sheep, and showed that there was an important female participation in this work. The author's results revealed that whereas women spent respectively, 49%, 25% and 16% of their time in grazing activities, cleaning of facilities and caring for lambs, men spend 84% of their time in grazing and 10% in milking sheep, showing that men carried out fewer tasks related to these animals. Vidal (1995b), in a study on 75 rural women conducted in Aragón (a Spanish semi-arid region) to analyze female labor at the Production Unit's level, observed that 56% of women were regularly associated with manual tasks with sheep, *roçado* and administrative work.

3.3. Components which explain the differences between peasant women

The Principal Component Analysis (PCA) for classifying peasant women found that the most important female were rearing swine and fowl and orchard-vegetable gardens. The PCA reduced the original number of variables by identifying those that were correlated, allowing the identification of the principal components related to rural women. A high frequency of work was found with non-ruminant animals and orchard-vegetable garden cultivation (Table 2). In Fig. 2, components are represented in tri-dimensional space defined by these axes. The first three components were chosen because together they explain the greatest proportion of original variance (80.06%) and display *Eigenvalues* > 1. The F1,

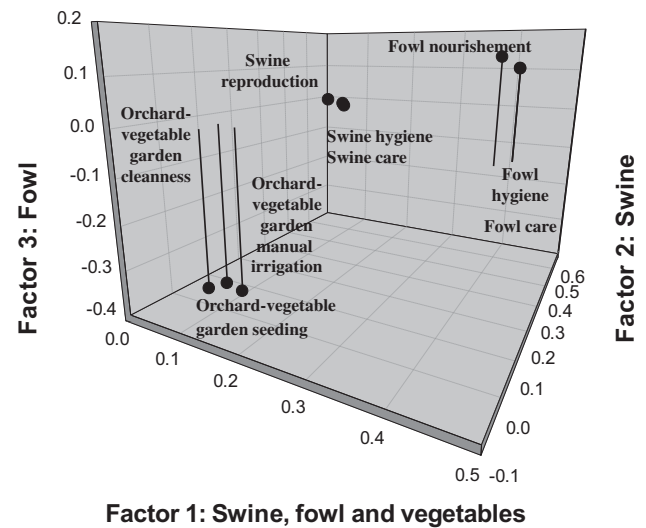


Fig. 2. Location of main variables in the tri-dimensional space defined by Factors 1–3.

which contributes 39.40% of explicative variance about the differences between rural women responsible for fowl, swine, orchard-vegetable garden activities, identifies women who manage tasks in the vegetable garden and/or orchard performing manual activities such as soil fertilization, manual removal of pests and harvesting, in contrast to the absence of activities such as sowing, weeding and/or manual removal of aphids and manual irrigation. The second component explains 22.14% of variance and reflects the rearing of swine, identifying women as responsible for controlling, cleaning and the reproduction of these animals. The last component, which accounts for 18.42% of inertia, refers to fowl rearing and is related to specific female labor in tasks related to the health, feeding and control of fowls.

3.4. Womens groups and the diversity of female responsibilities

Seven groups of women were obtained through Cluster Analysis (Fig. 3), conducted using factorial coordinates of observation for PCA components. Other variables which also explain relevant differences between groups, such as the sociological characteristic of women's age and the availability of structural factors in the FPU, are also shown in Fig. 3. These groups reflect the diversity of female agricultural labor in disadvantaged rural communities (Vidal, 1995a,b) in Ceará's semi-arid regions, particularly in the predominant allocation of female workforce for the production of fowl meat, eggs, pork meat, vegetables, fruit (Nierenberg, 2002), and in administrative tasks (other work) (Fig. 3).

The majority of groups are made up of women who are over 45-year-old (G1, G3, G5, G6 and G7) (Table 6). Of the seven groups, irrespective of family member responsibility, all women look after cattle, goats, and sheep (Table 7). However, it is worth pointing out that 67% of G2 FPUs are not involved in goat rearing activities, 50% of G1 and G4 do not own sheep and 50% of G1 and G3 do not work with cattle. Paid work for the rearing of ruminants only takes place in G6 and G7.

Only in G6 some women (7%) appear as being responsible for tasks related to goats and sheep. In the *roçado*, women also appear in small numbers and are associated with their husbands in G6 and G7, carrying out tasks related to the preparation of land: clearing out stumps or trunks, and burning the land followed by sowing. In all groups studied we can observe the woman is not the main person responsible for tasks related to ruminants, which are taken care of by the family as a whole. However, in tasks related to

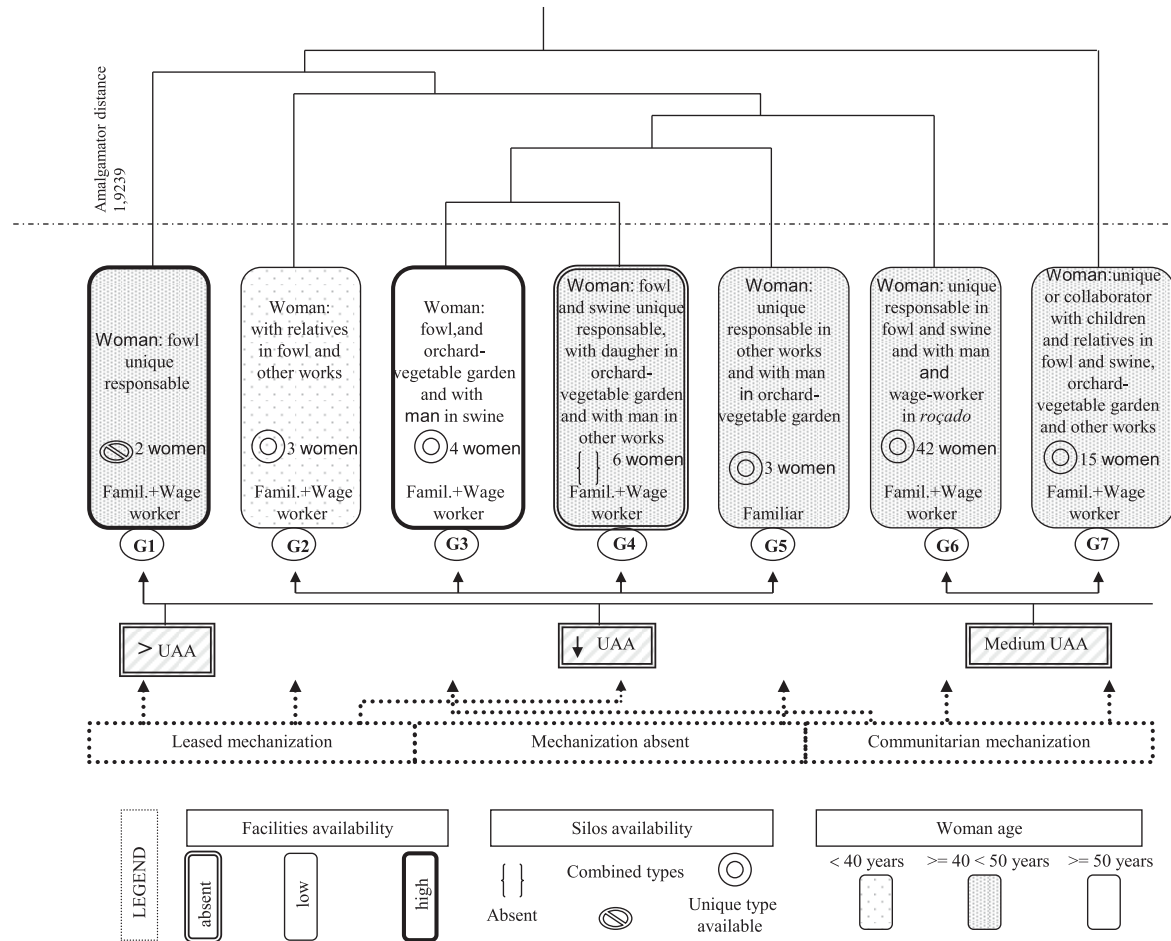


Fig. 3. Simplified dendrogram of rural womens groups from the Cluster Analysis.

administrative activities, accounting, and doing technical courses for the FPU, rural women appear in relevant numbers in G3, G4, G5 and G7 (Table 7).

3.5. Importance of availability of land and work factors related to female management

There was significant difference with regard to availability of land between the groups of women from G1, G5, G6 and G7, and no difference between the groups G2, G3 and G4 who possess

Table 6
Age, work factor characteristics and land availability among rural women by group.

Group	Women (%)	Age ^a		Family AWU ^b		UAA ^c	
		(Years)	CV ^d	(%)	CV	(ha)	CV
G1	2.67	50.00	0.31	73.91	ns	0.5	58.61*
G2	4	36.00	0.43	92.59	ns	0.14	13.00 ns
G3	5.33	55.75	0.20	94.44	ns	0.12	14.88 ns
G4	8	40.00	0.28	93.80	ns	0.1	14.70 ns
G5	4	49.67	0.11	100.00	ns	0	6.33*
G6	56	45.36	0.30	90.91	ns	0.16	28.07*
G7	20	47.00	0.28	91.33	ns	0.14	18.80*

^a Chi-square = 23.8 and $p < 0.0006$.

^b ANOVA: $F = 0.8721$ with $p > 0.05$; ns = not significant for all averages.

^c ANOVA: $F = 2.7679$ with $p = 0.0180238$ associated to *Bonferroni test for $\alpha = 0.05$.

^d Coefficient of variation.

intermediary quantities of UAA (Table 6). In G1, where those with the greatest amount of land are to be found (Table 6), women carry out tasks exclusively related to barn fowl (Table 7) as they are part of the smaller, though not significant, availability of a family workforce (Table 6). In G5, on the other hand, women who work in the orchards-vegetable gardens-and carry out administrative tasks (Table 7) have the smallest UAA of all the groups and fall exclusively within the family work factor (Table 6). G6, which has the majority of women (56%), the work was predominantly family work (Table 6) and had a UAA of intermediate size that was statistically significant. However, it is in G6 that paid work, less abundant than in G1, is distributed through a greater range of responsibilities associated to family work or that of the husband and linked to tasks related to *roçado* and ruminant animals (Table 7). The for the semi-arid of Ceará are in line with Brumer (2004) who reported that very often, in larger family production units, wives and daughters of owners do not generally participate or participate less intensively in productive activities. They are responsible exclusively for domestic work, looking after the orchard-vegetable garden- and perhaps associated with other activities (artisan processing of agricultural products, for example). In an earlier research conducted by Brumer (1994), the author observed a correlation between the size of property and the use of family workforce, as well as differences in the intensity of the employment of the female and male workforce according to the establishments size: the larger the available area, the smaller the female work factor.

Table 7Female participation in *roçado* (cultivation), ruminant cattle, other work, fowl, swine and vegetable garden-orchard management by group.

Activities	Groups (%)						
	G1	G2	G3	G4	G5	G6	G7
Roçado*							
Family	100	100	25	17	33	17	47
Husband	0	0	75	83	67	24	13
Family + Wage-earning worker	0	0	0	0	0	21	27
Woman + Husband	0	0	0	0	0	10	7
Husband + Associated work	0	0	0	0	0	10	0
Husband + Woman	0	0	0	0	0	19	7
Total (%)	100	100	100	100	100	100	100
Goats*							
Family	100	33	25	33	33	26	20
Children	0	0	25	0	67	5	7
Husband	0	0	50	33	0	31	40
Woman + Husband	0	0	0	0	0	7	0
Husband + Wage-earning worker	0	0	0	0	0	7	7
Absent	0	67	0	33	0	24	27
Total (%)	100	100	100	100	100	100	100
Sheep*							
Family	50	67	0	33	33	17	13
Children	0	33	25	0	33	5	7
Husband	0	0	50	17	33	31	20
Woman + Husband	0	0	0	0	0	7	0
Husband + Wage-earning worker	0	0	0	0	0	5	13
Absent	50	0	25	50	0	36	47
Total (%)	100	100	100	100	100	100	100
Cows*							
Family	50	100	0	33	33	19	7
Husband + Woman	0	0	0	0	0	5	7
Husband	0	0	25	33	0	17	27
Husband + Wage-earning worker	0	0	0	0	0	5	13
Children	0	0	25	0	33	7	13
Absent	50	0	50	33	33	48	33
Total (%)	100	100	100	100	100	100	100
Other work*							
Woman	0	0	50	33	33	17	33
Family	50	0	0	0	0	2	13
Woman + Relatives	0	67	0	0	0	12	13
Woman + Husband	0	33	0	17	33	19	13
Husband	0	0	50	50	33	29	20
Husband + Woman	50	0	0	0	0	21	7
Total (%)	100	100	100	100	100	100	100
Fowl*							
Woman	100	33	100	100	0	74	47
Woman + Relatives	0	67	0	0	33	26	53
Family	0	0	0	0	67	0	0
Total	100	100	100	100	100	100	100
Swine*							
Woman	100	0	50	50	0	29	33
Woman + Husband	0	0	0	0	33	29	33
Husband	0	67	25	0	0	10	7
Family	0	33	25	17	67	12	13
Absent	0	0	0	33	0	21	13
Total	100	100	100	100	100	100	100
Vegetables Garden-Orchard*							
Woman	0	0	75	17	67	12	20
Woman + Daughters	0	0	0	17	0	0	0
Woman + Husband	0	0	0	33	0	5	20
Family	0	67	25	33	33	5	47
Absent	100	33	0	0	0	79	13
Total	100	100	100	100	100	100	100

* $p < 0.0001$.

3.6. Relationship between the availability of facilities and mechanization

There was a significant difference between the groups in the availability of facilities (Table 8). It was observed that in the majority of groups this was low (G2, G5, G6 and G7), that is, the Family Farm Production Units (FPU), which make up each of these groups

Table 8

Dominant range production factor availability by group.

Groups	Facilities ^a	Silos ^b	Tractors ^c	Forage machines ^d	Other machines ^e
Dominant range					
G1	Intermediate	Combined	Hired	Available	Absent
G2	Low	Available	Hired	Available	Absent
G3	High	Available	Community owned	Absent	Absent
G4	Absent	Absent	Hired	Absent	Absent
G5	Low	Available	Absent	Absent	Absent
G6	Low	Available	Hired	Absent	Available
G7	Low	Available	Community owned	Absent	Absent

^a Chi-square: $p < 0.0018$.^b Chi-square: $p > 0.05$.^c Chi-square: $p > 0.05$.^d Chi-square: $p < 0.0070$.^e Chi-square: $p < 0.0001$.

and which correspond to 85% of women, have only one facility for animals. Only the four women in G3, who are the only ones in this study that had exclusive responsibility for orchards-vegetable gardens (75%) (Table 7), had more facilities at their disposal (over 3) (Table 8).

There are no animal facilities available in G4, which has six women who were uniquely responsible for fowl rearing and who shared with the family the care of swine, and with the husband and other family members responsibilities for the orchard-vegetable gardens (Table 7); in G1, where women were uniquely responsible for fowls and swine rearing, there were intermediate facilities (Table 8). As to the availability of silos there was no statistical significance; however, in the majority of women's groups there were silos (G2, G3, G5, G6 and G7), but there were none in G4 (Table 8) where women perform a wide range of rural activities. The extent of the availability of machines is low in all groups, and in G5 there were no machines (Table 8). There was no significant difference between the groups with regard to tractors ($p > 0.05$), though the presence of foraging machines was significant (G1 and G2 – present) (G3, G4, G5, G6 and G7 – absent). With regard to other machines, these were only available in G6. All tractors were collectively owned in G3 and G7 and were hired in G1, G2, G4 and G6. In G5, there was lack of mechanization of any type. It is the only group where women were not responsible for fowl and swine rearing. However, they were responsible, with the help of men, for orchards-vegetable garden tasks, and their daughters were responsible for small ruminants. Women are also responsible for other work they do by themselves. Association is observed between the lack of forage machinery, the presence of other machines and exclusive female management of monogastric animals (Tables 7 and 8).

3.7. Women's importance in rural management in different environments

The rearing of fowl and swine is a daily activity among women in a number of economically peripheral countries. Sinn et al. (1999) and Fakoya et al. (2006) argue that even when men and women in dependent rural economies work side by side, women are typically responsible for small barn animals, which allows them to increase the family's level of food security.

In the present study it can be seen that women emerge as the unique or primary person responsible for barn fowl rearing in six groups, covering 96% of women in the study (with the exception of Group 5 where they participate as collaborators in the family environment) (Table 7). Thus, these results corroborate those of

Okitoi et al. (2007) on women in a wet environment in the western region of Kenya, and those of Ogunlade and Adebayo (2009), also on a wet climate region (Nigeria). With regard to swine rearing, in our findings, women in the semi-arid rural communities in Ceará participated significantly as they were uniquely responsible and/or primarily responsible in five groups (G1, G3, G4, G6 and G7, a total of 92% of 75 women) (Table 7). These results corroborate those of Valencia et al. (2007) for rural women in Mexico who, besides being leaders in local communities, perform important economic activities such as swine rearing. Moreover, these results are also consistent with those of Bawa et al. (2004) on women in Nigeria, who are responsible for 67.75% of all labor related to family swine rearing in that country. With regard to women's responsibility for production in orchards-vegetable gardens, it was observed that out of the six groups where these activities were carried out, women were the main persons responsible, including daughters and husbands in G3, G4, G5 and G7, reaching a total of 37.33% of women in the study (Table 7). In these groups the main vegetables cultivated were parsley, chives and lettuce; and the main fruits extracted were melon, mango and guava. It can also be observed that in groups of women with orchard-vegetable garden-responsibilities, there is less availability of land (Table 6) when compared to groups where the cultivation of fruit and vegetables is absent (G1). This association between the presence of an orchard-vegetable garden in rural families with no land or with little land availability corroborates the results of Frankenberger et al. (1989), who analyzed family orchards-vegetable gardens worked by women Mauritania in a region with low land availability. In data collection from different vulnerable environments one can observe that activities that are important to women's micro-economies are diverse in both semi-arid and wetlands areas as well as in coastal regions. In the semi-arid regions, it can be seen that women are responsible for tasks related to goats (Darcan and Davran, 2009), sheep (Fernandez, 1992; Kumar, 2004), sheep associated with cereal cultivation and administration (Vidal, 1995b), fowl rearing and cereal cultivation (Cousins et al., 2007; Kleinbooi and Lahiff, 2007), fowl and swine rearing (Rahaman, 2003), farming tasks in general (NDT, 1994), preparing the soil (Irving et al., 1993) and collecting fruit, water and wood (NISER, 1991). In mountain wetlands there is evidence for diversification of female activities such as goat rearing (Karanja-Lumumba and Mugivane, 2009; Rahaman, 1995; Willmer and Ketzis, 1997), planting, weed control and harvesting (Stock, 2004), domestic fowl rearing (Ogunlade and Adebayo, 2009; Okitoi et al., 2007) swine rearing (Valencia et al., 2007) and dairy cattle (Mullins et al., 1996). Finally, in coastal areas, women are primarily responsible for goats (Baer et al., 2009; Lebbie, 2004). Thus, we can deduce that in vulnerable areas, in particular in semi-arid and arid environments, women's micro-economic territorial strategy is associated with a greater number of activities. Rather, it is the result of a relationship established through the association between women's work and the availability of other work factors, as is shown in the detailed discussion about female labor paradigms that follows.

3.8. Complementarity and subordinated division of female work

There are two prevailing paradigms which guide associative analyses in studies about female work: interdependency or complementarity and subaltern division. The first is linked to less capitalized rural societies, that is, those that have kept their fundamental peasant character.

Evidence from African societies, such as in the Kalahari Desert (Bieseles, 1993) or Kenya (Karanja-Lumumba and Mugivane, 2009) and also from Honduras in Central America (Willmer and Ketzis, 1997) have elucidated the tradition of productive systems based

on interdependency and complementarity of different work carried out by women and men in Family Production Units. For Becker (1993), Bieseles (1993), Irving et al. (1993), Stock (2004) and Trenchard (1987) among others, the division of labor based on gender is arguably complementary. This was observed in the *Ju/'hoan* society in the Kalahari Desert where dominant men and women are a reflection of the mutual interdependence of both sexes (Bieseles, 1993). Whilst this interdependence could have been an aspect of pre-colonial societies (Becker, 1993), the current division of labor seems to have been distorted by the ongoing economic and social changes in the majority of groups in Namibia. For example, the transformations from rural economies based on agriculture to economies based on income increased the burden of female work. Women compensate for the loss of resources resulting from the absence of their husbands and other family members by taking up additional tasks. An example reported by Irving et al. (1993) in Ovamboland (Namibia) showed that in 45% of FPU's, women are responsible for preparing the land, whereas in only 27% of cases men contributed to this task. Stock (2004) and Trenchard (1987) compared the labor division between African peasant women and men in various rural communities in Kenya, Gambia and Ghana. In the mountain regions of Luo and Kikuyu in Kenya, the authors observed that women were responsible for planting, weed control and harvesting and men for the initial cleaning of the land. In the Mankinka region in Gambia, women cultivated rice in marshland and men cultivated millet and sorghum in mountain areas where there was no competition between the genders for land (Stock, 2004). However, in the hot regions of equatorial Ghana, women cultivated cassava only in marginal areas and to do so they have to ask permission from the men who dedicate themselves to the production of cocoa in more fertile land (Trenchard, 1987).

The second paradigm is based on the sexualized division of labor, defined as men's control over women's capacity, with the aim of perpetuating unequal access to the means of production (Hastings, 1987–1988). This was the explicative basis of the dependency relationship of women's work to the pattern decided by men (partner or not) in African societies in the semi-arid areas of South Africa (Kleinbooi and Lahiff, 2007), Namibia (NDT, 1994), and Mexico (Baer et al., 2009). In the current study, in general terms it can be seen that in G4, G5 and G7 the range of women's activities in rural tasks were more diverse, and in G1 less diverse. However, it is G6 and G7, encompassing the majority of women in the study ($n = 67$), where existing differences show evidence of possible differences in the strategies of women in relation to interdependence and to the subaltern division of labor. In G6 there is a greater presence of diversified and hired mechanical capital, male work and paid work, and also, an absence of orchards-vegetable gardens. Therefore, there is a greater dependence on external inputs and lower female participation. In G6, despite having the highest number of women studied, women's participation in rural tasks was restricted, merely complementary to the work of men. Since these women do not dominate organized transactions, being dependent on the economic-political decisions of their partners, these strategies can be taken as subordinated (Okali, 2009). In G7 the inverse happens: the only mechanical asset is the tractor, collectively owned. There is a higher involvement of family labor, an absence of pesticide use and the prevalence of women working with barn animals, orchards-vegetable gardens, and in the administration and management of the production unit. Therefore, there is lower capitalization and dependence on external inputs and greater diversification of female responsibilities; interlinked components which motivate a fundamentally peasant farming system (Vidal and Alencar, 2009).

Since the women in G7 have wide-ranging and more complex activities, including those related to organization, together with all

factors which characterize a peasant economy, this group falls within the dynamics of the interdependent paradigm. Furthermore, 40% of the peasant women in this group belong to the Junco community where orchard-vegetable garden sales predominate (Vidal, 2009). We can detect the presence of interdependent dynamics as these women are responsible for economically important activities where there is no subordination with regard to their work. However, for the majority of women in this study, the classic invisibility (FAO, 1997) of their work is confirmed, as demonstrated for contemporary Brazil by Fischer and Gehlen (2002).

4. Conclusions

The exploratory nature of this study led to the emergence of knowledge about the responsibilities of rural women and identified issues and needs of these micro-economic agents. The integration of specific variables relating to female work revealed associations in the management of the productive unit which would not have been detected by means of conventional indicators, such as “family help”. These results demonstrate that female work is important to the functioning of family farm production units in the semi-arid regions in the Brazilian Northeast. The establishment of explicative statistical components shows the main female micro-economic occupations as being fowl and swine rearing as well as orchards-vegetable gardens. Womens’ partners are less interested in interfering in female control of these means of production because they are considered less valuable in comparison to *roçado* and ruminant management. Thus, women can freely manage these resources for family needs. The highly significant differences in these variables between groups of women suggests that the typology developed is valid.

The work activities of rural women are relevant to all disadvantaged geographic areas discussed i.e., humid mountain and lowland, coastal area, semi-arid and arid. However, it is in the semi-arid environment that rural women are able to cover a much broader spectrum and fuller management activities when compared to other areas. In the semi-arid regions they cover all rural management activities (domestic swine and fowls, orchards-vegetable gardens, small and large ruminants, administrative works, cereal crops) and also planting, weed control, harvesting, water and wood collecting. Their ability to perform these activities is because these women combine different strategies in an efficient and dynamic way, adapting themselves to the demands of labor and the natural environment. Moreover, their actions contribute to the maintenance of productive diversity in semi-arid regions.

Despite restrictions in the availability of larger plots of land, it was observed that the work of rural women is predominantly more complex when compared to that of men in semi-arid regions. As well as being responsible for carrying out specific productive tasks with the non-ruminants they share, to varying degrees of responsibility, they undertake other rural tasks related to larger cattle and typical agricultural work such as cultivating cereals.

The implications of this study for public policy relates to the need to consider the resources and knowledge of rural women of semi-arid or arid disadvantaged regions. Applied research and participatory specialization courses on improving technologies should be developed that add value to and strengthen endogenous components of the rural women micro-economic system. The recognition and enhancement of female micro-economic work will certainly contribute to maintain and to fortify women in these ecologically and economically vulnerable regions. Other wider issues for arid lands is the low educational level of women, associated with insufficient land availability to the peasant class which maintains unequal access to the means of production. Despite this restriction, peasant women are capable of developing crucial tasks

in different and complex rural activities to guarantee food security of semi-arid and arid populations.

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