

**ORGANIC PRODUCTION: PROPERTIES CHARACTERIZATION AND MECHANICAL SITUATION ON WEED CONTROL**Roger Toscan Spagnolo<sup>1</sup>, André Oldoni<sup>2</sup>, Tiago Vega Custódio<sup>3</sup>, Antônio Lilles Tavares Machado<sup>4</sup> & Ângelo Vieira dos Reis<sup>5</sup>1 - Engenheiro Agrícola, Professor do IFRS/Sertão-RS, [roger.toscan@gmail.com](mailto:roger.toscan@gmail.com)2 - Engenheiro Agrícola, Professor do IF Sul/Pelotas-RS, [andreoldoni@gmail.com](mailto:andreoldoni@gmail.com)3 - Engenheiro Agrícola, Doutorando da UFPel/Pelotas-RS, [tiagovegacustodio@gmail.com](mailto:tiagovegacustodio@gmail.com)4 - Engenheiro Agrícola, Professor da UFPel/Pelotas-RS, [antoniolilles@gmail.com](mailto:antoniolilles@gmail.com)5 - Engenheiro Agrícola, Professor da UFPel/Pelotas-RS, [areis@ufpel.edu.br](mailto:areis@ufpel.edu.br)**Keywords:**cultivation techniques  
family farming  
machines and implements**ABSTRACT**

In the last few decades, there has been a significant increase in organic products demand, which are produced without pesticides use. In Rio Grande do Sul, the Sul-Ecológica Cooperative, composed by 250 families, is the representative for organic products production and sails and was a reference to embody this study. The work aimed to characterize the production standards used by organic farmers for their properties, crops cultivated, methods for weed control, traction used and income. The results evidenced organic farmers to own small properties and use the pull-off and manual weeding process for weed control. The crops produced were, in order of importance, corn, beans, potato, fruits and greenery. Operations for weed control were manually done or with the help of animal traction. Overall, monthly gross income was considered low.

**Palavras-chave:**agricultura familiar  
forma de cultivo  
máquinas e implementos**PRODUÇÃO ORGÂNICA: CARACTERIZAÇÃO DAS PROPRIEDADES E A SITUAÇÃO DA MECANIZAÇÃO NO CONTROLE DE PLANTAS ESPONTÂNEAS****RESUMO**

Nas últimas décadas houve um aumento significativo da demanda de produtos orgânicos, os quais são produzidos sem a utilização de agrotóxicos. No Rio Grande do Sul, a cooperativa Sul-Ecológica constituída por 250 famílias, é representativa do processo de produção e de comercialização de produtos orgânicos, sendo referência para a realização do presente estudo. O objetivo deste trabalho foi caracterizar o modo de produção utilizado pelos agricultores orgânicos, suas propriedades, produtos cultivados, formas de combate às plantas espontâneas, tipo de tração utilizada e renda familiar. Os resultados evidenciaram que os agricultores orgânicos concentram-se em pequenas propriedades, utilizam como principal forma de combate às plantas espontâneas o arranquio e a capina manual. As culturas produzidas, em ordem de importância, são milho, feijão, batata, frutíferas e hortaliças. As operações para o controle de plantas espontâneas são realizadas manualmente ou com auxílio de animais de tração. A renda mensal bruta dos produtores é considerada baixa.

## INTRODUCTION

In Brazil, the area used for family farming is significantly lower than the one used for other models of agriculture. Nevertheless, the family farming is responsible for a huge part of Brazilian food security since it is an important food source for the internal market, producing 87% of cassava, 70% of beans, 46% of corn, 38% of coffee, 34% of rice, 58% of milk, 59% of swine, 50% of poultry, 30% of bovine, and, also, 21% of all Brazilian wheat. (IBGE, 2006).

According to Barbosa *et al.* (2011), in a study performed with costumers that are used to frequenting organic products fairs, the low availability and high prices are discouraging factors towards their consumption. Still, organic consumers who buy in fairs have a higher income in relation to those who buy in other commercial centers; also, even though most consumers consider the price of organic food more expensive than conventional, most state a better quality of life as the main reason for to continue buying organic produces (PEREIRA *et al.*, 2015).

Organic food production, according to Panzenhagen *et al.* (2008), provides concrete benefits to the neighbors of these organic properties in regards to environmental pollution, which can sometimes be negligible, contributing, thus, on the natural resources recovery and on the harvest of products with no pesticide contamination, which contributes to their quality. Moreover, organic production provides to the farmer personal satisfaction for producing, consuming and offering healthier products to customers.

Castro Neto *et al.* (2010) claim the possibility of organic production to represent an alternative for family farming in regards to social, environmental and economic effects, once consumption awareness tends to be an important worldwide trend. This relevancy given to organic production can collaborate, therefore, with sustainability and family farming product valorization.

Nevertheless, family farmers face difficulties to increase their production because they own small farming areas and family labor is becoming rare. Many use conventional farming as the main agricultural practice in which soil preparation,

sowing, weed control and harvest operations are, mainly, performed with handle machinery. According to Oliveira *et al.* (2009), sowing is done through hand operated drills, such as rattles, and weeds are controlled through manual weeding, associated or not to animal traction by a harness. Despite these challenges, farmers consider organic farming a method for diversifying the production and promoting their economic and social development by adding values to their products (CASTRO NETO *et al.*, 2010).

In this social, economic and technological context, the present work aimed to characterize organic farmers properties by addressing their means of production and force sources employed, as well as their strategy for weed control and income.

## MATERIAL AND METHODS

Information among organic food producers was collected through interviews composed of seventeen questions, being three free choice questions, five multiple choice questions, and nine open questions. The questionnaire was conceived according to Marconi e Lakatos (2010), who claimed questions order must follow a logical progression. First, the informant answered the questions by interest, so these must be attractive and there cannot be any controversy. Second, the informant must answer questions determined as easiest and then the most difficult ones. Also, premature answers must be avoided, and personal information questions must be the last ones in the questionnaire. Lastly, the answers must gradually be conducted from a reference board to another to improve understanding.

According to these recommendations, the first questions performed were related to characterization of the rural properties where production takes place (place, total area, farming area, and soil type). Afterwards, the questions regarded the crop produced and the method used for weed control. Finally, the purpose of the last questions was to collect information about initially accepted cost for a weed controller device with no pesticide use.

In regards of the open and objective simple choice questions, the data were structured according to the total number of answers. The following equation,

suggested by Gil (2008), was used to estimate sample numbers:

$$n = \frac{N.p.(Z_{\alpha/2})^2}{p.(Z_{\alpha/2})^2 + (N-1).E^2} \quad (1)$$

Where:

n = sample size;

p = percentage were the phenomena was verified, estimated;

N = population size;

E<sup>2</sup> = maximum error permitted;

Z $\alpha/2$  = reliability interval chosen, expressed in deviation numbers;

The questionnaires were applied to a group of producers in collaboration with the Sul-Ecológica Cooperative, which has 250 cooperators (N= 250). Since this population was totally formed by organic producers (p= 100), 100% of the studied cases were considered. A minimal sample of 20 producers was obtained considering a reliable interval of 98% (Z $\alpha/2$ = 2,32) and an error of 5% (E= 5). However, 23 producers were interviewed through meetings and fairs promoted by the Cooperative.

### RESULTS AND DISCUSSION

The majority of properties presented a total area between 10 and 20 ha, and only 4,3% of them had an area higher than 30 ha (Figure 1).

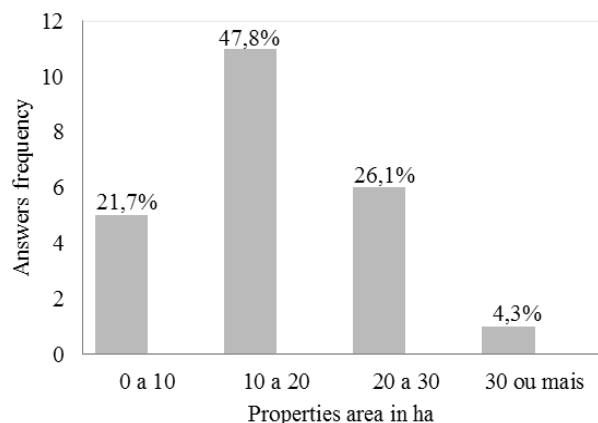


Figure 1. Total property area.

However, the actual organic farming area used was between 5 and 10 ha (52,2%), hence more than a half of organic properties are for food production (Figure 2).

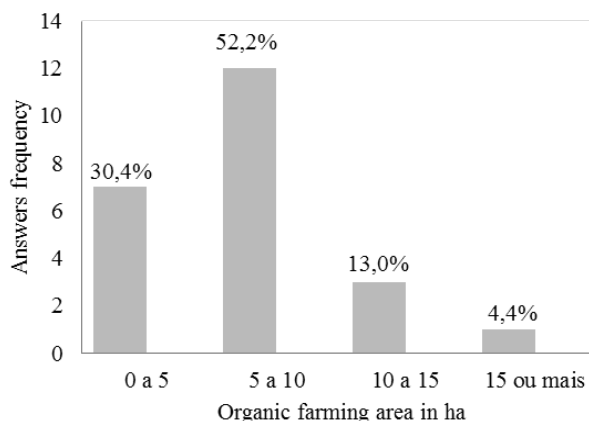


Figure 2. Organic farming area.

Teixeira *et al.* (2009), portraying a group of organic farmers and their relation with agriculture mechanization in Rio Grande do Sul, verified 69,6% famers had properties with a total area up to 20 ha and 65,2% occupied an organic farming area of up to 5 ha. Storch *et al.* (2004), in a similar study, described 21% of the properties with an area lower than 10 ha while 58% oscillated between 11 and 20 ha. Organic production occupied an average of 30% total property total.

Total property area are still described as small and producers have not acquired more land in the last few years; however they have increased the organic farming area. This increase confirms Cunha *et al.* (2011) statement addressing a growth in organic food search and farmers interest for alternative production systems that increase income, improve their life quality in the countryside and preserve soil productive capacity.

The conventional soil preparation technique was practiced on 88,0% of the properties (Figure 3). This result confirms the data obtained by Teixeira *et al.* (2009) that verified 82,6% of properties conventional soil preparation technique.

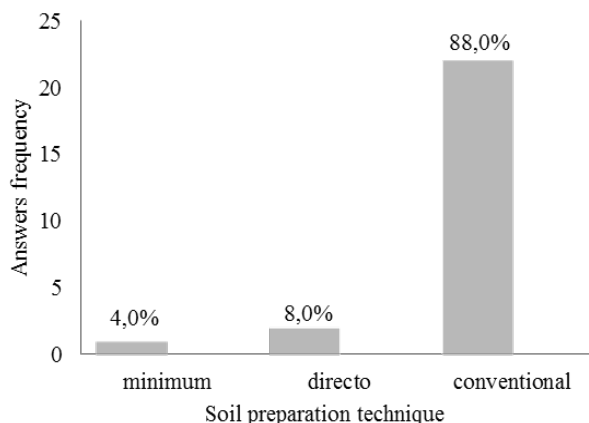
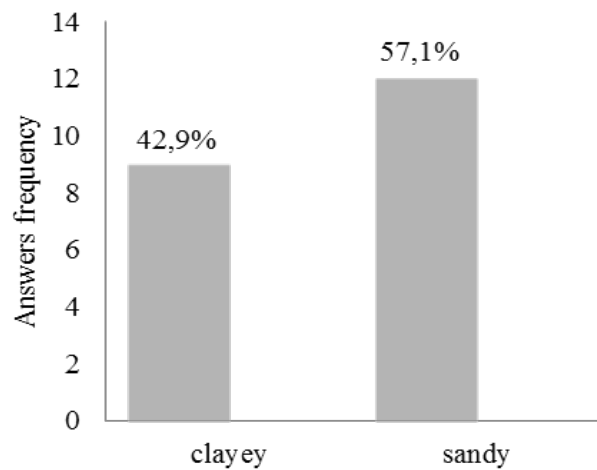


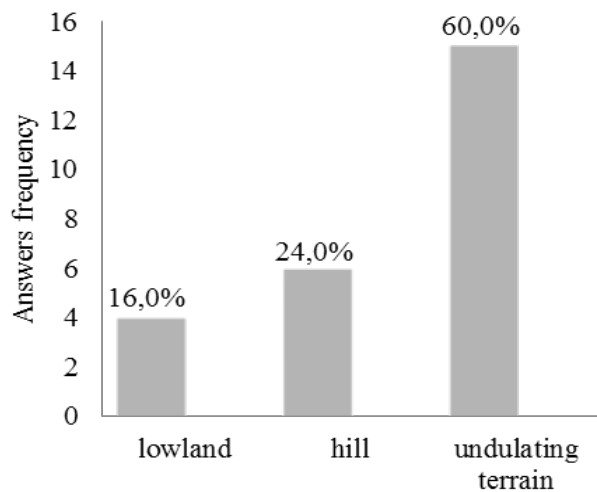
Figure 3. Soil preparation technique.

The soil was assessed according to Teixeira *et al.* (2009) through which the perception of the farmer was analyzed as to the environment of the farming area (qualitative approach). Thus, the soil was described in a simple way according to texture (sandy, clayey), relief (lowland, hill and undulated terrain) and surface rock presence. Most farmers described the soil as sandy (57,1%) and composing an undulated terrain (60,0%), according Figure 4.

Most farmers (52,4%) also considered their properties stony. A wavy and stony terrain is difficult for machines and other farming equipment circulation when these are used for weed control because the procedure is generally linked to a product application on a target or direct intervention on it and the irregularities present can cause a fail.



(a) Soil type - texture

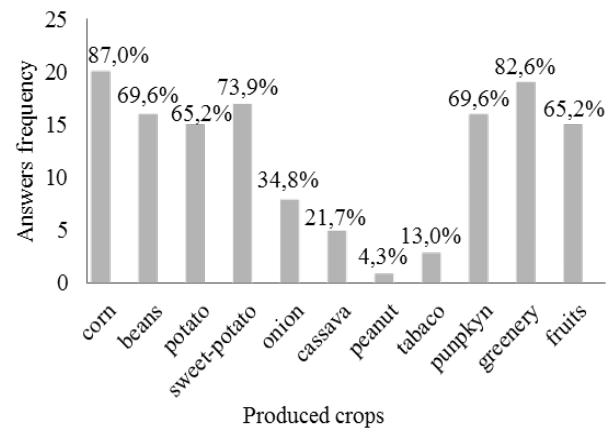


(b) Soil type- relief

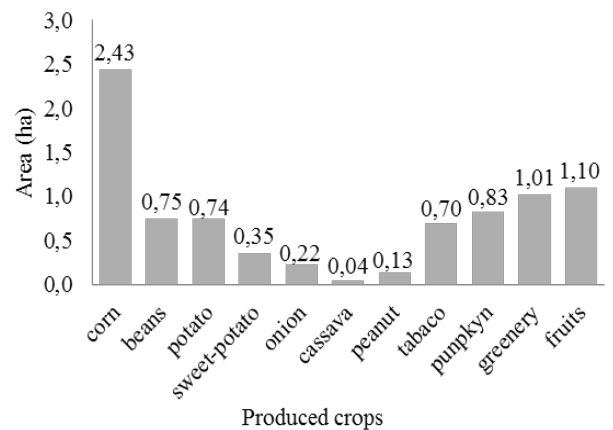
**Figure 4.** Soil type assessment.

The production of a wide crop variety (Figure 5) was verified. The farmers interviewed considered this wide range of variety essential to reduce food cost in the supermarkets. The most important crop was corn, produced by 87% of the farmers on an average area of 2,5 ha (Figure 6). Other crops produced were beans, potato, fruits and greenery.

The area used for some cultures, such as cassava, onion, peanut and sweet potato are small, could be further used for family-consumption only. Due to the wide variety of products produced, these farmers, to treat the crops with no use of pesticides, needed a device would allow a variation of the distance between the lines.



**Figure 5.** Produced crops in the properties.



**Figure 6.** Produced area by crop.

When farmers were questioned about weeds, many species were considered responsible for damaging the greenery and the annual crops (Figure 7). Also, the *Digitaria sanguinalis* and

*Brachiaria plantaginea* grass were said to be the most common weeds, and, since these are monocotyledons species (strait leaves), specific weed control devices must be considered in order to cut them during maintenance and hinder their growth.

The farmers also highlighted weed management to be done during their initial development phase. Weed control among greenery is performed twice to four times according to the greenery produced and the bed infestation degree. In corn and beans cultures, this control is performed in an average of twice a season and up to 60 days after an emergency, when the crops (corn and beans) are between 30 and 40 centimeters high, according to Figure 8.

When addressing weed control techniques (Figure 9), the farmers declared more than one type of approach, being mainly manual weeding (95,7%) and pull-off (43,5%). These results are in accordance to Darolt & Skora Neto (2002) who affirmed the manual weed, allied to other management actions, has been used in organic production systems to replace pesticide that are not admitted on these systems. Mechanical methods for weed control are more effective on agility and ergonomics when compared to manual ones (weeding and pull-off). However, manual weeding as done by the farmers is ideal because the machine grid can cause a soil mobilization and weeding devices and brushcutters can cause the weed regrowth.

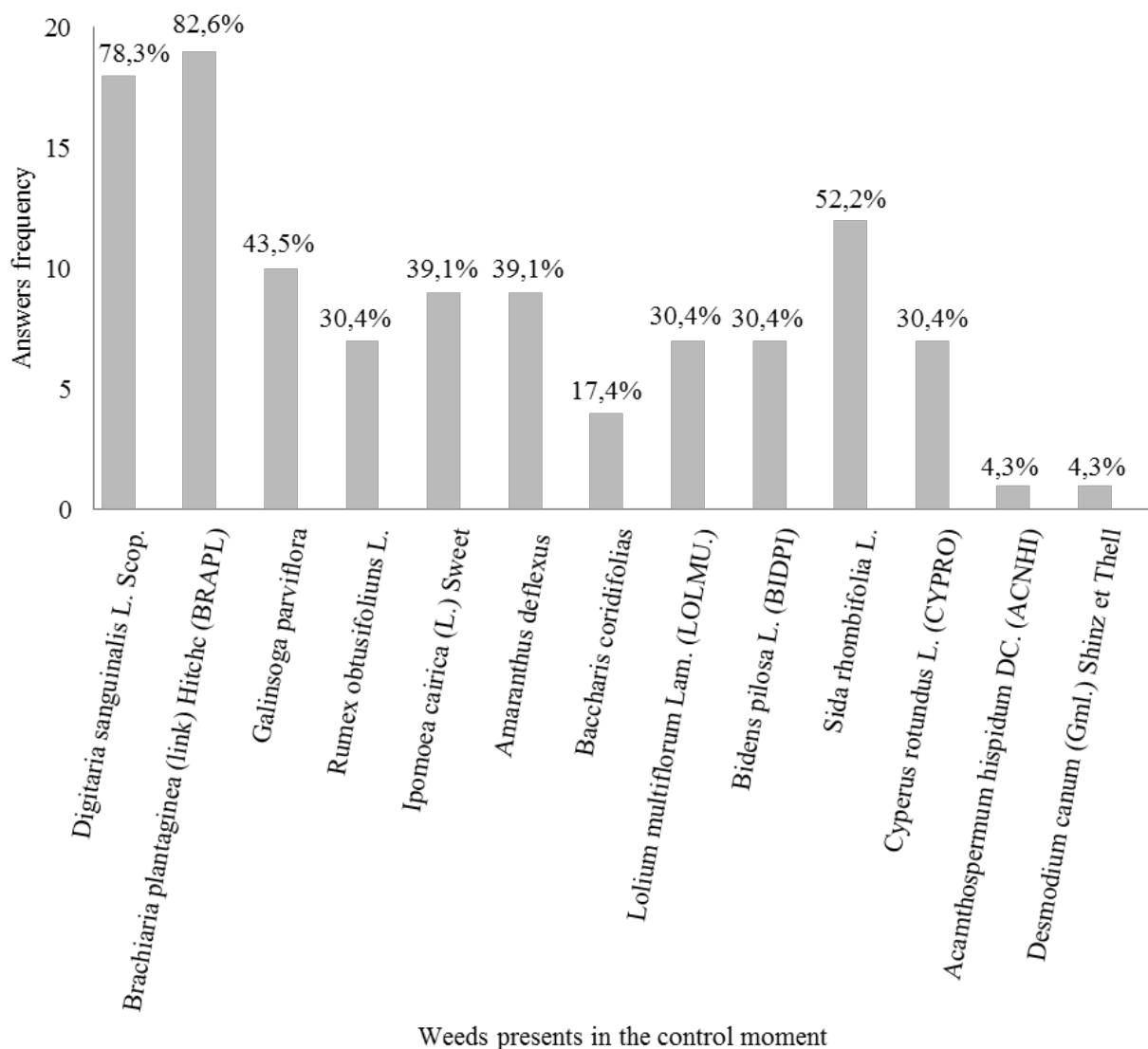
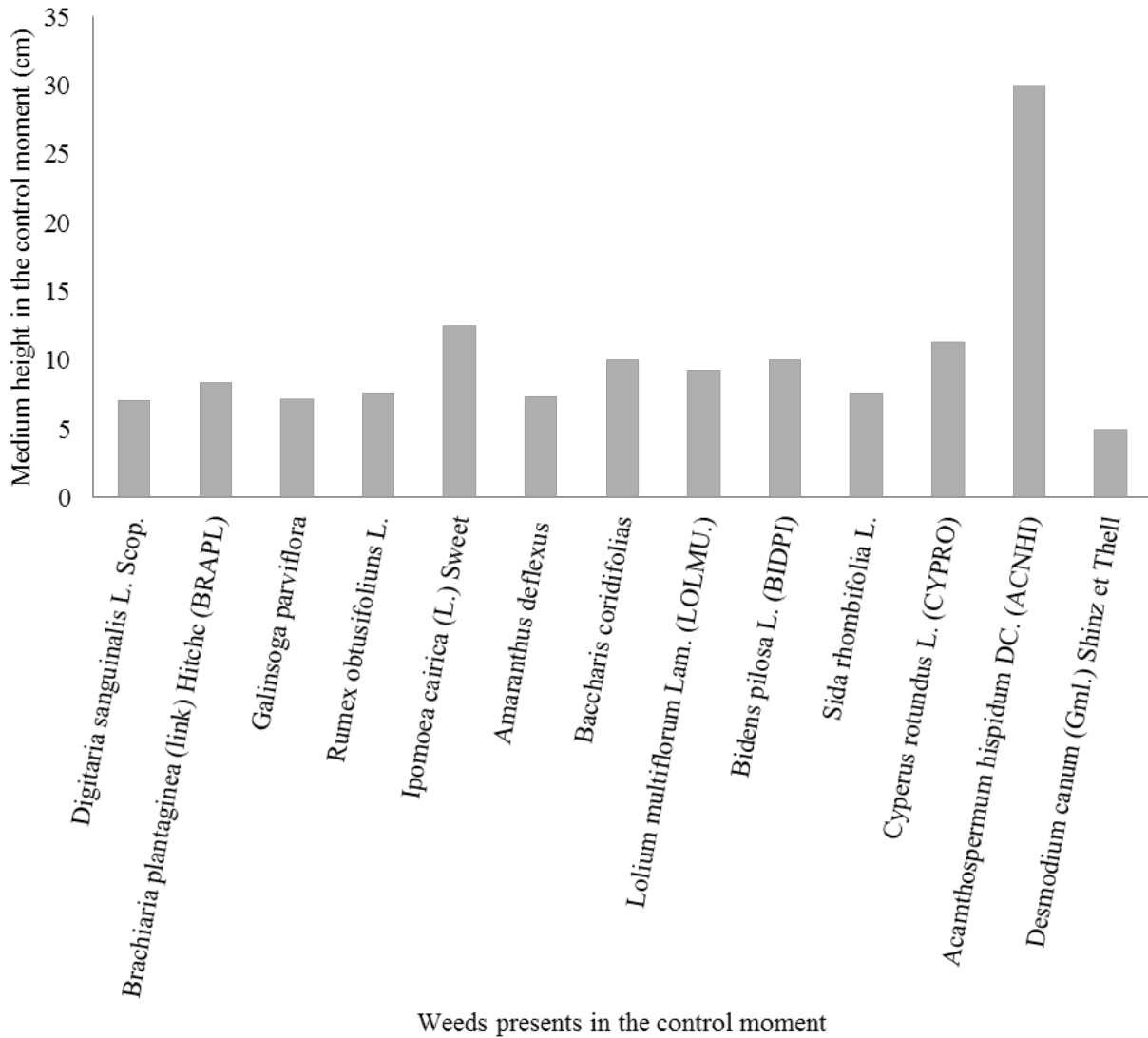
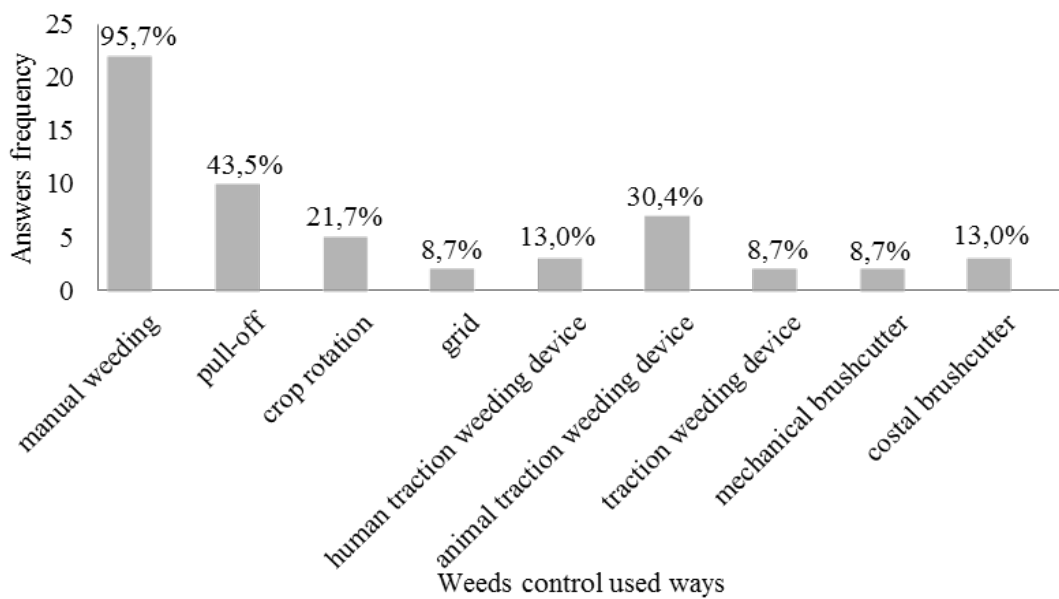


Figure 7. Weeds present on the farm.



**Figure 8.** Weeds medium height during weed control.



**Figure 9.** Weeds control used ways.



Brighenti & Brighenti (2009) affirm brushcutters and electrical discharge devices as alternatives for weed management in organic farming systems. However, the brushcutter is not effective for mono- cotyledons species (strait leaves).

Devices generating tension of 4.400 and 6.800 volts are effective, however, they are expensive and demand great attention during the operation. The grid, plow, roll-knife, weeding and pull-off use are all weed control methods but none of them allow straw development without soil mobilization or a cut which favor weed regrowth.

The eco-correct alternative is thermal treatment, which can be harmful when used incorrectly by disrupting the plant cell and turning them inactive incapacitated to grow new buds (VIRBICKAITE et al., 2006). Researches made by Ulloa et al. (2012) have shown that the thermal treatment is an efficient and economic method. Wszelaki et al. (2007) inform that this method besides desiccating the weeds has provided benefits to tomato crop, decreasing the rot incidence and controlling insects from soil.

Another positive aspect of heat use for weed control is that dead plants can serve as straw, allowing organic farmers a direct sowing system use, which provides an increase on water availability to the plants near the surface and less energy retention in comparison to the traditional preparations (DALMAGO et al., 2009).

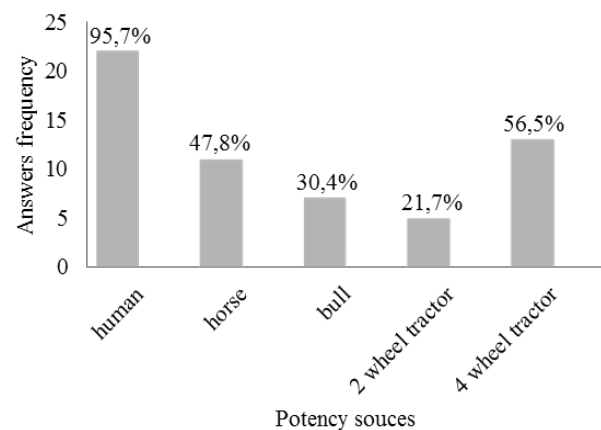
A soil with vegetal covering allows humidity maintenance, microbial activity increase and organic material incorporation as well as a soil erosion decrease. In the same way, direct plantation system would reduce equipment use and worker amount needed for soil preparation activities.

Most farmers use more than one potency source (figure 10), however, in general, they must use their own physical effort to make the weeding or the pull-off to weed control. Animals are also used as a potency force, 47,8% of the interviewed used horses and 30,4% bulls.

In regards of mechanical sources energy

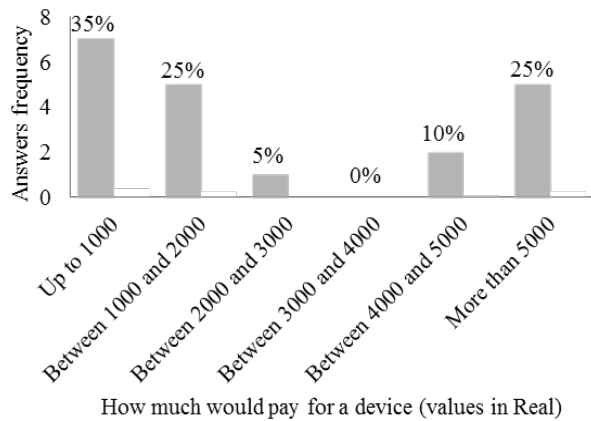
percentage, 56,5% of the interviewed farmers used a four-wheel tractor with a potency lower than 55 kW and 21,7% a two-wheel tractor with a potency of 9,6 kW. This can be linked to easy money obtained along the financial bank system with government incentive through the Family Farming Improvement National Program (*Programa Nacional de Fortalecimento da Agricultura Familiar – PRONAF*).

However, these tractors are not commonly used for weed control, which can be linked to the market lack in relation to machines and implements with no pesticide use. Therefore, farmers, even though tractors owners, must manage weed control through manual weeding or pull-off. And, when tractors are used, farmers are forced to use equipment that promote soil turn over or weed regrowth due to market shortage of appropriate machines and equipment.



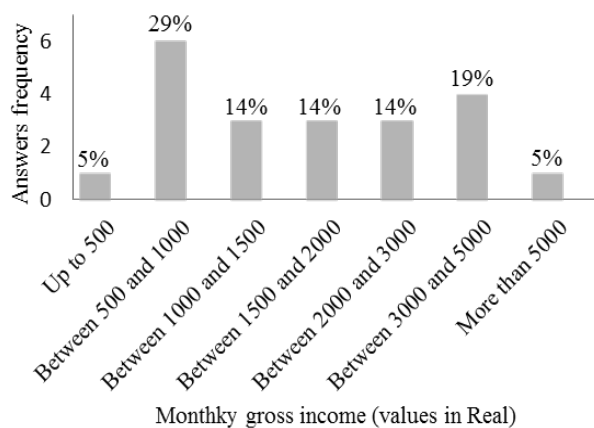
**Figure 10.** Types of traction used in the properties.

When asked about their financial situation, most of the farmers felt embarrassed about these questions and some didn't answer those addressing monthly gross income and income available for new machine acquisition. From the 23 farmers interviewed, 20 said how much would be disposed to pay for a weed control device or implement with no pesticide use. From these, 35% would pay less than R\$ 1.000,00, but 25% would pay up to R\$ 2.000,00 and 25% would pay more than R\$ 5.000,00, even if there was a need to ask for financial support (Figure 11).



**Figure 11.** Values that a farmer would pay for a farming device that is able to control weeds.

These varied investment values do not match with the gross income of the farmers once 5% receive lower than R\$ 500,00, 29% between R\$ 500,00 and R\$ 1.000,00, 28% between R\$ 1.000,00 and R\$ 2.000,00, 14% between R\$ 2.000,00 and R\$ 3.000,00, 19% between R\$ 3.000,00 and R\$ 4.000,00, and only 5% have a gross income higher than R\$ 5.000,00 (Figure 12). This elucidates the values exposed on Figure 10 and proves that the farmers have difficulties to expand their production and make new investments. According to Esperancini *et al.* (2007), the low investment capacity of these farmers is one of the main barriers to new technologies adoption.



**Figure 12.** Property monthly gross income.

Organic farmers have difficulties to acquire devices and implements adapted to their specific needs due to their low monthly gross income and the short offer of these devices in the market (TEIXEIRA *et al.*, 2009). This, allied to the

other results exposed in this work, highlight the farmers need for modern technology, machines and equipment of low cost production, acquisition and maintenance. In conclusion, regarding weed control, organic food farmers need a device capable of controlling weeds without pesticide application or soil turn over, as well as capable of preventing weeds regrowth. In addition, these devices must have a low production cost.

## CONCLUSION

- The organic farmers in the south of Rio Grande do Sul practice farming in small land using manual weeding and pull-off methods to control weed growth.
- The main crops produced are corn, greeneries and sweet potato.
- Their monthly income is considered low and it does not exceed R\$ 5.000,00 in the majority.

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