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RESEARCH ARTICLE

PHYSIOLOGICAL QUALITY OF LANDRACE SEEDS FROM RURAL COMMUNITY SETTLEMENTS IN PARAÍBA, BRAZIL

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ABSTRACT

Seed storage is an important step of production for family farmers. However, storing seeds requires an assessment of physiological qualities to set the best storage method and avoid loss of seed variety. In this work, we evaluated the physiological quality of landrace seeds of bean (*Vigna unguiculate*) and maize (*Zea mays*) from a seed bank of rural communities settled at Paraíba, Brazil. The study was carried out in the seedling nursery of the Federal Institute of Education, Science and Technology of Paraíba (IFPB – Souza). The seeds were collected from three rural settlements: Frei Damião (Cajazeiras – Paraíba), Padre Cleides (Santa Helena – Paraíba), and Três Irmãos (Triunfo – Paraíba). We carried out the germination test, vigor test (first count of germination, length of aerial part, and root length), and assessed the moisture and oil content of seeds. The results showed that seeds from Padre Cleides settlement had 97% of germination of 78. 25% of vigor. All seeds from Três Irmãos settlement germinated but showed only 51% of vigor. The lowest physiologic quality was found for seeds from Frei Damião rural settlement, showing a percentage of germination of 60% and 62% and vigor of 4% and 0% for 'Branco' and 'Roxo' maize, respectively. 'Ligeiro' and 'Costela de Vaca' bean varieties from Padre Cleide and Três Irmãos settlements showed high viability for production and marketing. The 'Azul' variety of bean from Padre Cleide settlement showed lower values of germination (25%) and vigor (8%) than other varieties, being not suitable for production and marketing. We suggest the renewal of this variety by exchanging seeds with other communities.

INTRODUCTION

Since the beginning of humanity, farmers have conserved, selected, and improved seeds, giving rise to a great diversity of crops and varieties used in agricultural production. Farmers are the main responsible for the maintenance of crop biodiversity that provides varieties adapted to different regions. Nowadays, crop biodiversity has decreased due to the increase in agribusiness. Landrace seeds, called "creole seeds" in Brazil, have been part of people's lives since the discovery of agriculture. Collectively, farmers discovered and evolved techniques and practices, as the handling of landrace seeds (Albarello *et al.,* 2009). The seed quality is one of the main inputs of agriculture, which determine the success or failure of crops. Local varieties of seeds are a component of agro biodiversity of high value for traditional populations. Good quality seeds have high cost and require technical assistance which is not accessible to small farmers. Therefore, a viable alternative is the collective production of seed varieties, both for subsistence and marketing. About 90% of the seeds used by small producers in developing countries come from informal seed banks (Didonet, 2007). But, the use of low physiological quality seeds, with low potential for germination and reduced vigor, leads to crops with poor yield (Medeiro Filho; Teófilo, 2005). In the semi-arid region of Paraíba, Brazil, the Community Seed Banks (CSBs) has the objective of stocking of corn and beans from one year to the next. The CSBs has contributed to the conservation and recovery of local species and cultivars adapted to the ecosystems and consumption patterns of the region (Almeida; Cordeiro, 2002). The moisture content of seeds varies according to the environment in which they are exposed, leading to losses in the conservation of seeds (Marcos Filho *et*

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al., 1987). Therefore, evaluate the physiological status, aiming the correct stocking process in collective banks or the seed reproduction, is important to maintain the physiological quality and reduce losses of varieties. The tests of germination and vigor are used to evaluate the physiological quality of seeds for sowing and commercialization. The germination test can be performed under ideal and artificial conditions and allows to obtain the maximum percentage of germination. The vigor test is more sensitive and aims to provide complementary information about the emergence potential of seedlings in the field under different environmental conditions. In this context, the aim of this work was to evaluate the physiological quality of the seeds of bean (*Vigna unguiculata*) and maize (*Zea mays*) from community seed banks settled in the semi-arid region of Paraíba to guide the conservation and stocking process of seeds.

Agroecological and family based agriculture

Family-based agriculture has different origins in Brazilian regions. The dependence of agribusiness in agriculture politics made the family-based agriculture a subjugated and invisible socio-economy. The latifundia, dominant in all Brazilian history, imposed itself as a socially powerful model (Motta; Zarth, 2008). Most of rural properties in the country, about 4. 5 million, are family-based farming composed of small and medium-sized producers (Portugal, 2004). Family farming is the main source of agricultural production for domestic supply of population and is a source of income for many Brazilian families. Although family farming plays an important role for many Brazilian regions, as the main economic activity, it is necessary to guarantee the easy access to credit, technological conditions, and resources for a sustainable production, besides the commercialization of the agricultural product (Nazzari *et al.,* 2010). Improvements in credit conditions and technologies might boost and diversify the family-based agriculture bring dynamism to rural areas (Veiga *et al.,* 2001). Family-based agriculture accounts for 85. 2% of rural establishments. This group of producers depends on high-cost hybrid seeds that require high control of production, soil correction, pest control, and external inputs, which reduce the productivity and the family income (Albucarma, 2008). Seeds produced and selected by farmers, such as landrace seeds, might be an alternative to increase the gains in production. The demand for sustainable development and environmentally friendly products has helped to increase the family-based agriculture, creating employment and income, and developing local communities. In this context, agroecology represents an alternative based on the principles of sustainability of agroecosystems and solidarity among rural producers (Altieri, 1998; Santos, 1999). The aim is to balance the social, environmental, and economic dimensions using management techniques that combine economic development with the rational and sustainable use of available resources. For Almeida *et al*. (2006), sustainable agriculture is not a kind of production or system of production but a set of practices that respect the time of nature, using just what nature can replace. Organic farming is a system of production that avoids or excludes the use of pesticides, artificial fertilizers, growth regulators, and additives for animals, but makes the use of green manure, such as legumes and forage, or dead organic matter such as dry straw, animal manure. Resulting from agronomy and ecology, the agroecology provides the knowledge and methodology needed to develop an agriculture that is environmentally consistent, highly productive, and economically viable (Glissman, 2005). Agroecology aims to restore the harmonious relations between man and his natural environment, managing methods created by the own farmers. The greatest challenge is to rescue the peasant knowledge, which, allied to research, could result in a new production system with agroecological characteristics (Altieri; Nicholls, 2003).

Landrace seeds

Landrace seeds are those that have not undergone genetic modification. These seeds are called creole or native because their management has been developed by traditional communities, such as the indigenous, quilombolas, ribeirinhos, and caboclos (Trindade, 2006). Landraces play a significant role in the development of ecologically based systems, aiming the conservation of agrobiodiversity and the autonomy of family-based agriculture. The Brazilian law 10. 711/03 regulates the national system of seeds and seedlings, officially recognizing them as important for the guarantee of biodiversity and food security. However, the law does not regulate the quality control of native cultivar material, as occurs for commercial cultivars in the market (Campos *et al.,* 2006). The current stock of landrace seeds in the rural communities is small, impairing the agricultural production and the food security in poor regions. Landrace populations, also known as local breeds, are important materials for cultivation due to their high adaptation potential to environmental conditions (Paterniani *et al.,* 2000). The seed production process should be based on the high quality of the seeds to supply seeds within the required legal standards, maximizing the productive potential of the crops and increasing the income of the family farmers (Santos, 2012). In the northeastern semi-arid region of Brazil, drought periods are long, with little or no agricultural production during the drought years, which affects the family stock of food as well as the seed stock. In these extreme situations, the seeds end up being destined to the food consumption rather than stocking, since they are the only available sources. The consumption of seed stocks during drought years affects the next crop and increases the risks of genetic erosion of local varieties (Almeida and Cordeiro, 2002). Since landrace seeds best suit each region, the knowledge of the genetic diversity of these genotypes is fundamental for the correct use of this resources (Loarce, 1996), the sustainability of family-based agriculture, and the use of seeds from their previous crop (Trindade, 2006)

Landraces of maize

Maize belongs to the Plantae kingdom; Anthophyta Division; Class Monocotyledonae, Order Poales; Poaceae family; *Zea* genus; *Zea mays* species (Doebley, 1990). This genus is composed of a group of grasses, some perennial and others annual, native from Mexico and Central America. Also belonging to the group of plants C4, maize shows high photosynthetic rate, increasing the yield with luminous intensity. Maize stands out among the most important forage plants, due to its highly productive and nutritional potential, being very used in the feeding of dairy cattle and beef cattle (Lima *et al.,* 2009). Besides, it represents one of the world's major cereals, being grown in small, medium, and large farms (Fancelli; Dourado Neto, 2000). It is a food rich in carbohydrates, considered as energetic, and source of oil, fibers, vitamins E, B1, B2, and pantothenic acid, as well as some minerals such as phosphorus and potassium (Matos *et al.,* 2006). Due to its several uses, both in human food and animal feed, it reaches a relevant socioeconomic role and is also used as raw material, diversifying the agroindustry (Fancelli; Dourado Neto, 2000; Cruz *et al.,* 2006). Brazil is the third largest producer of maize in the world, with a production of 4. 7 million tons. In 2013, Mato Grosso became the largest national maize producer, accounting for 25. 0% of the national production, surpassing Paraná, which currently occupies the second position, accounting for 21. 7% (IBGE, 2013). Maize is one of the most important agricultural products in northeastern Brazilian, due to the large rural population and as a basic component in animal feed (Carvalho *et al.,* 1998). In this region, maize is exploited in a range of different environmental conditions and different farming systems, from traditional ones to the most modern ones, which use modern production technologies to exploit the full potential of the crop (Carvalho *et al.,* 2000).

Landraces of maize are cultivated by small producers in their traditional communities, helping their subsistence by the use as food and for commercialization, consisting in an alternative for organic and sustainable agriculture (Trindade, 2006). Seeds from local or native cultivars are considered as components of agrobiodiversity since they have high value for traditional populations (Catão *et al*. 2010). The use of local or native cultivars have advantages linked to the sustainability of production, such as resistance to diseases, pests, and climatic imbalances (Carpentieri-Pipolo *et al*. 2010). Also, the seeds can be stored and used in subsequent harvests, enabling a lower cost of production (Romano *et al.,* 2007). Native maize cultivars are those that, introduced over a long period, have undergone a process of adaptation to certain regions through selection carried out by farmers (Ferreira *et al.,* 2010). In the state of Paraíba, landrace seeds are known as "Sementes da Paixão" (Seeds of Passion) and have been reproduced by family farmers since their ancestors and guarantee of the autonomy and diversity of peasant agriculture in the semi-arid region (Santos *et al.,* 2004). Landrace maize, a breed with high genetic variability and high rusticity, can grow under a system of medium to low technological investment with profitable productivities (Sandri and Tofanelli, 2008). Commercial varieties of maize may show a similar or inferior performance as landrace using low growing technologies (Carpentieri-Pipolo *et al.,* 2010). Nowadays, native maize has been distributed to farmers, mainly linked to family agriculture and rural settlements (AGRICULTURA FAMILIAR, 2004).

Landraces of beans

Beans are used since the earliest records of humanity. Common bean, belonging to the class Dicotiledoneae, family Leguminosae, subfamily Papilionoideae and genus *Phaseolus*. The genus *Phaseolus* comprises about 55 species of which only five are cultivated. The species *P. vulgaris*, known as common bean, is widespread and consumed in several countries (Prolla, 2006). The bean plant belongs to the family Fabaceae. They are natural source of proteins, calories, vitamins, and minerals. It is a culture closely related to subsistence activities with significant socioeconomic importance (Freire Filho *et al.,* 2011). The 'Canapu' bean (*Vigna unguiculata*) was brought to Brazil by African slaves in the 16th century, coming from eastern Africa. It has become a common plant in northeastern Brazil and is now generally referred to as 'Corda' bean, 'Caupi' bean, or 'Macassar' (Batista, 2007). This bean provides prominent crops in north and northeastern Brazil, consisting of the main protein and energy food for farmers and their families (Santos *et al.,* 2009; Lima *et al.,* 2007 apud Silva, 2011). The incorporation of bean varieties might be important for the rural economy due the productivities obtained and the ability to adapt to low rainfall regimes (Santos *et al*. 2009). The cultivation of these genotypes by small and medium farmers provides the conservation of the genetic resources and allows the usage in programs of improvement of bean culture.

Physiological quality of seeds

High-quality seeds ensure higher productivity in the field. Seed quality is the sum of all the genetic, physical, physiological, and health attributes that affect the seed's ability to originate high productivity plants (Popinigis, 1985; Marcos Filho, 2005). The physiological potential of their cultivar is an important factor that must be seen by farmers. The assessment of physiological quality of seeds for sowing and commercialization has been based on germination tests. However, results of germination test can overestimate the physiological potential of the seeds when conducted under controlled conditions (Barros *et al.,* 2002). In this case, the vigor tests evaluate the best performance of cultivated seeds at the field conditions (Vieira *et al.,* 1994; Barros *et al.,* 2002). Seed vigor represents a set of characteristics that determine the potential for emergence and rapid development of seedlings (Marcos Filho, 2005). However, the seeds vigor tests do not have a standard methodology but are commonly used by seed companies to determine the physiological potential of seeds (Marcos Filho, 1999). Vigor test should evaluate the germination in the field, detect differences between lots with similar germination and identify storage potential, as a complementary tool to the germination test (Haesbaert, 2013).
Vigor test considers the average length of normal seedlings, since the samples expressing the highest values are more vigorous (Nakagawa, 1999). More vigorous seeds give rise to seedlings with higher growth rate, due to the greater translocation of storage tissue reserves to the growth of the embryonic axis. Seedling length tests are suggested by the Association of Official Seed Analysts (Aosa, 1983) and are currently widely used in seed analysis laboratories because they have the advantages of not being expensive, are relatively quick, and do not require special equipment and training on the technique.

Physical composition of seeds

The main substances stored by seeds are carbohydrates, lipids, and proteins. The major reserve of carbohydrates in the seeds is the starch. When starch is the predominant reserve substance, the seed is called amylaceous. Seeds are called oleaginous when the lipids are the predominant reserve substances. Also, there are seeds which the main substance are proteins, as gluten and aleurone grains. Also, minerals, vitamins, and other substances can be found in small amounts. In general, grass seeds have a high carbohydrate content, and the legumes have high protein content (Carvalho and Nakagawa, 2000). Maize grains are usually yellow or white, but may have colorations ranging from black to red. The average individual grain weight varies from 250 to 300mg, and its average dry composition is 72% of starch, 9. 5% of protein, 9% of fiber, and 4% of oil. It is known botanically as a karyotype. The grain is composed of four main physical structures: endosperm, germ, pericarp (peel) and the tip which differ in chemical composition and location inside the grain (Paes, 2006). The germ represents 11% of the maize grain and comprises almost all the lipids (oil and vitamin E) (83%) and the minerals (78%) of the grain, besides having important amounts of proteins (26%) and sugars (70%). However, maize oil has a composition of polyunsaturated fatty acids like soybean and sunflower oils (Paes, 2006). In these oleaginous vegetables, the main component is linoleic fatty acid, which is considered essential to human nutrition and some animals, given the incapacity of the body to synthesize them. Bean is a basic food mainly for the Brazilian Northeast populations. Bean and maize crops are cultivated predominantly in the semiarid of the Northeast region. Beans are an important source of proteins (23% to 25%) and carbohydrates and have a high content of dietary fibers, vitamins, and minerals, besides having a low amount of lipids (an average of 2%) (EMBRAPA MEIO NORTE, 2003). Beans, in addition to increase the amount of protein in the diet, also contribute to improving its quality, when the protein source of the diet consists of legumes and cereal, because legumes are deficient in sulfur amino acids, while cereals are deficient in lysine (Toledo; Canniatti-Brazaca, 2008). The chemical composition of the beans is an important factor in the quality of the final product and has been studied by different authors. The chemical composition of bean seeds can vary according to the variety, origin, location, climate, environmental conditions, soil type, storage, processing, and genetic modifications.

MATERIALS AND METHODS

Location of the experiment

This work was carried out at the nursery of the Experimental Farm of the Federal Institute of Education, Science and Technology of Paraíba, Sousa (IFPB-SOUSA), irrigated perimeter of São Gonçalo, Paraíba (6 ° 50 '33 "S and 38 ° 17 '54" W, 264 m of altitude). The local climate, according to the Koppen classification, is BSh, hot and dry (semi-arid), with total annual rainfall less than potential evapotranspiration. The annual average temperature is 27°C, with a maximum of 38°C and a minimum of 18°C. The relative humidity varies between 45 and 77% with annual average rainfall of 654 mm. Landrace seeds of beans and maize were collected from the seed bank of the following settlements: Frei Damião, Padre Cleides, and Triunfo, located in Cajazeiras-PB, Brazil.

Germination test

The germination test was carried out with four replicates of 50 seeds, planted in plastic trays (with dimensions of 25 x 39 x 7. 5 cm). We used a substrate of moistened sand, irrigated daily, and placed at room temperature of IFPB-Campus Sousa. Counts were made at five and eight days for beans and four and seven days for maize corresponding to the first and last germination count, respectively, according to the Rules for Seed Analysis (BRASIL, 2009).

Vigor test

a) **First germination count:** carried out concomitantly with the germination test.

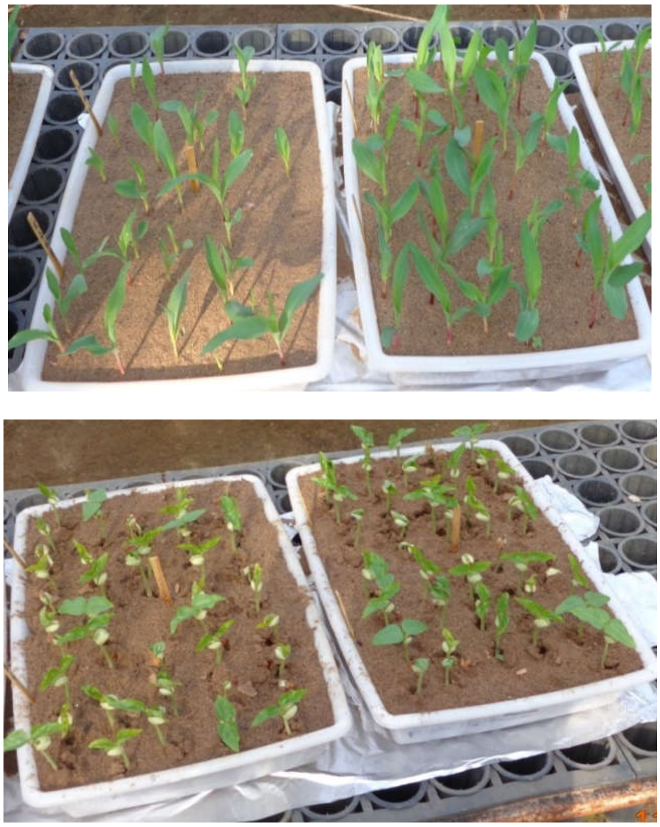

Figure 1. Germination test of landraces a) beans (*Vigna unguiculata*) and b) maize (*Zea mays*), from the seed bank of Frei Damião, Padre Cleides and Triunfo rural settlements, Cajazeiras-PB, Brazil. Photo: Sousa 2013

b) **The length of aerial part of seedling (LA):** determined by direct measurements using a graduated ruler in centimeters, measuring from the cervix to the apical bud.
c) **The length of the root portion of the seedling (LR):** measure from the cervix to the end of the primary root
d) **Seed moisture content:** determined by the greenhouse method at low temperature (105 ± 3ºC for 24 hours), according to Brasil (2009).
e) **Seed oil content:** We used the methodology for chemical extraction proposed by Moretto (1998). The chemical extraction was carried out using solvents. Initially, the seeds were dried in an oven at 50 °C for 48 ours and grounded in a blender to enable solvent penetration. The extraction was done using a Soxhlet extractor, with an approximate temperature of 67 °C, using n-hexane as solvent and extraction time of 6 hours. We used a rotavaporator to remove the solvent.

Data analysis

To test for the differences between seed varieties we used the Analyzes of Variance (One-Way ANOVA) using the Sisvar 3. 01 software (Ferreira, 2000) and posthoc Tukey test at 5% probability level. The compared landraces of maize were: 'Amarelo', 'Vermelho', 'Branco', 'Roxo', and 'Porto Rico'. Landrace beans were: 'Ligeiro', 'Costela de Vaca', and 'Azul'.

RESULTS AND DISCUSSION

Table 1 shows the average values of percentage of germination and vigor, root length, shoot length, moisture content, and oil content of native maize seeds from Padre Cleides (P. C.); Três Imãos (T. I.); and Frei Damião settlements (F. D.) All assessed characteristics, differed significantly among varieties, except the oil content. Maize seeds from P. C. and T. I. settlements showed higher percentages of germination than seeds from Frei Damião (Table 1; Figure 4). Vigor, root length, shoot length, and moisture content were also higher in P. C. and T. I. seeds. The 'Amarelo' variety, from P. C. , and 'Porto Rico' variety, from T. I. , showed germination percentages higher than 90%. The lowest germination percentage allowed in a certified seed of maize is 85% (Rocha *et al*. 2009). Our results show that the varieties 'Branco' and 'Roxo' from F. D. settlement were characterized as low-quality seeds, with small values of germination (Table 1). These varieties also show small values for vigor test: 4% and 0% of vigor; root length of 11. 3 cm and 7. 10 cm; length of the aerial part of 2. 79 cm and 1. 8 cm, respectively (Table 1; Figure 5). Seeds cultivated under optimal conditions and using partially deteriorated seeds can germinate and produce seedlings that, although weak, are included in the percentage of germination. The vigor test, therefore, is useful to evaluate the physiological quality of the seeds with accuracy (Padua, 1998). The high quality of maize seeds in Padre Cleides and Três Irmãos settlements might be due to stocking time, although the stocking conditions were similar between all settlements. Inadequate storage conditions, with high humidity and high temperatures, combined with the type of packaging used (usually permeable or semipermeable) have a significant

Figure 2. Vigor test of landrace seeds of a) bean(*Vigna unguiculata*) and b) maize (*Zea mays)*, c) measures of aerial part and d) measures of the root. Seeds were takenfrom the seed bank of Frei Damião, Padre Cleides, and Triunfo rural settlements, Cajazeiras-PB, Brazil. Photo: Sousa 2013

Figure 3. Oil content determination of native bean seeds (*Vigna unguiculata*) and maize (*Zea mays*) from the seed bank of Frei Damião, Padre Cleides and Triunfo rural settlements, Cajazeiras-PB, Brazil. Photo: Sousa 2014

Table 1. Average values of germination, vigor, root length, shoot length, moisture content and oil content of landraces of maize from rural settlements, Sousa-PB, Brazil, 2014

Treatments(Localities)	Germination (%)	Vigor(%)	Root length(cm)	Aerial length(cm)	Moisture(%)	Oil(%)
P. C. 'Amarelo' Maize	97.00 ab	78.25 a	21.40 a	4.88 a	8.77 a	2.76 a
P. C. 'Vermelho' Maize	74.00 b	19.00 b	14.77 b	3.40 b	8.67 a	3.24 a
T. I. 'Porto Rico' Maize	100.00 a	51.00 ab	13.78 b	2.79 bc	8.45 ab	3.13 a
F. D. 'Branco' Maize	60.00 c	4.00 c	11.03 bc	1.80 c	7.68 b	3.03 a
F. D. 'Roxo' Maize	62.00 c	0.00 c	7.10 c	2.16 c	7.51 b	2.81 a
CV(%)	13.45	67.13	14.72	16.90	5.00	14.03
F test	**	**	**	**	**	Ns

Settlements: (P.C.) Padre Cleides; (T.I.) Três Irmãos; and (F.D.) Frei Damião. Averages followed by the same letter at the column consists of treatments that do not differ from each other by the Tukey test. ** p<0.01; * p<0.05; ns. Not significant.

Table 2. Average values of germination, vigor, root length, shoot length, moisture content and oil content of native bean from rural settlements, Sousa-PB, Brazil, 2014

Treatments(Localities)	Germination(%)	Vigor(%)	Root length(cm)	Aerial length(cm)	Moisture(%)	Oil(%)
P.C. 'Ligeiro' Bean	94.00 a	94.00 a	13.83 a	14.86 a	10.01 a	0.46 a
T.I. 'Costela de Vaca' Bean	100.00 a	100.00 a	13.10 a	10.86 ab	8.75 a	0.51 a
P.C. 'Azul' Bean	25.00 b	8.00 b	6.41 b	7.36 b	9.60 a	0.60 a
CV(%)	6.13	4.43	12.52	18.50	8.20	14.02
F test	**	**	**	**	ns	Ns

Settlements: (P.C.) Padre Cleides; and (T.I.) Três Irmãos. Averages followed by the same letter, at the column, consists of treatments that do not differ from each other by the Tukey test. ** p<0.01; * p<0.05; ns. Not significant.

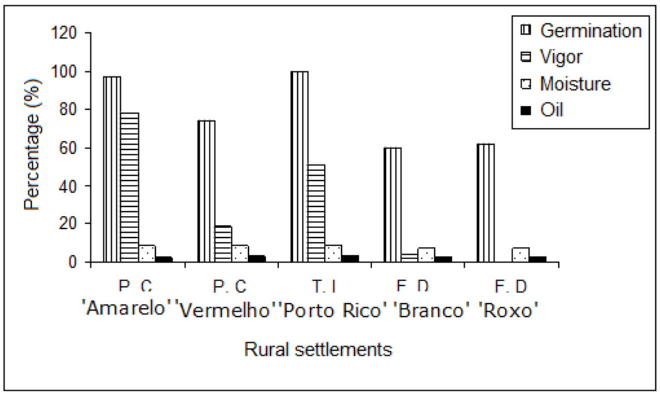

Figure 4. Average values of germination, vigor, moisture, and oil of native maize varieties ('Amarelo', 'Vermelho', 'Porto Rico', 'Branco' and 'Roxo') from rural settlements Padre Cleides (P. C.), Três Irmãos (T. I.), and (F. D.) Frei Damião. Sousa-PB, 2014

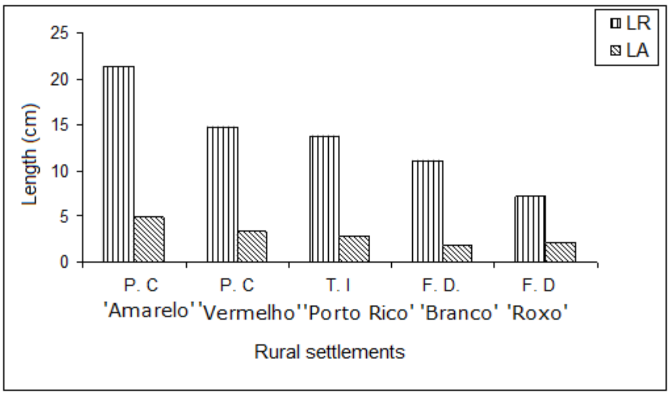

Figure 5. Average values of root length (LR) and length of aerial part (LA) of native maize varieties ('Amarelo', 'Vermelho', 'Porto Rico', 'Branco', and 'Roxo') from rural settlements Padre Cleides (P. C.), Três Irmãos (T. I.), and (F. D.) Frei Damião. Sousa-PB, 2014

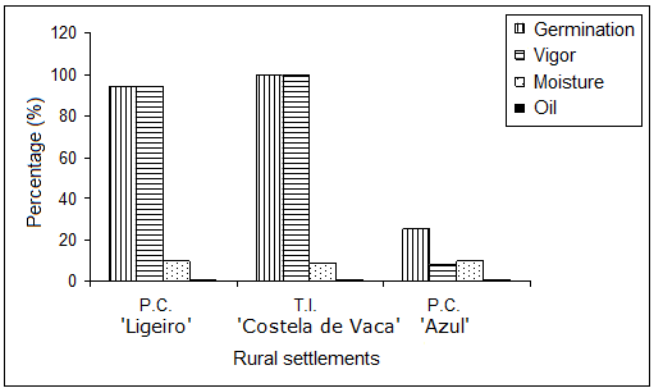

Figure 6. Average values of germination, vigor, moisture and oil of native beans varieties ('Ligeiro', 'Costela de Vaca', and 'Azul') from rural settlements Padre Cleides and Três Irmãos. Sousa-PB, 2014

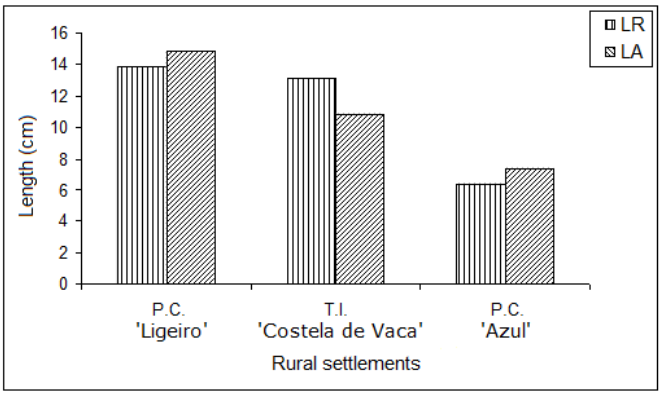

Figure 7. Average values of root length (LR), length of aerial part (LA) of native beans varieties ('Ligeiro', 'Costela de Vaca' and 'Azul') from rural settlements Padre Cleides and Três Irmãos. Sousa-PB, 2014

influence on the seed conservation, contributing to the decrease in germination values (Antonello *et al.,* 2009). Rolin *et al.* (2012) evaluating native seeds collected in seeds banks from Cariri region, concluded that the type of storage did not influence the results of the germination test, finding a germination level of 85. 7%. Costa *et al.* (2013) evaluating the physiological quality of seeds of native maize (Cabeça de Negro variety) and commercial seeds (Caatingueiro and AL Bandeirante) used in the city of Vitória da Conquista-BA, showed that native seeds presented higher physiological quality than commercial varieties.

The moisture analysis of the maize seedlings did not differ among the 'Amarelo', 'Vermelho', and 'Porto Rico' landraces, with values ranging from 7. 51% to 8. 77% (Table 1; Figure 4). The small variation among varieties is necessary for standardization of assessments and obtaining consistent results (Haesbaert, 2013). Oil content did not differ among varieties, independent of the locality of storage (Table 1; Figure 4). 'Vermelho' variety showed the highest oil content (3. 24%). Similar results were reported by Paes (2006). Table 2 shows the results of ANOVA and average values of germination, vigor percentage, root length, shoot length, moisture content, and oil content of landrace seeds of beans from the settlements P. C. and T. I. Table 2 shows a significant effect for all evaluated traits except for the moisture and oil content of seeds. The 'Ligeiro' and 'Costela de Vaca' landraces showed the highest germination values (94% and 100%, respectively) (Figure 6; Table 2). There was no location effect over the percentage of germination. Both varieties had values of germination higher than 80%, regarded as the minimum standard required value for commercialization of bean seeds (BRASIL, 2009). The 'Azul' bean had the lowest germination rate (25%). Considering that the "Ligeiro" and "Azul" beans had the same storage conditions at the same locality, we can infer that the 'Azul' seeds probably have already been stored with poor viability. The high rate of germination and vigor of 'Ligeiro' and 'Costela de Vaca' varieties (94% and 100%), together with the highest root (13. 83cm and 13. 10cm, respectively) and aerial lengths (14. 86cm and 10. 86cm, respectively), suggest the high viability of these seeds (Table 2; Figure 7). Native seeds are viable and vigorous for both root length and shoot length (Lima *et al.,* 2012). Similar results were found for commercial varieties (Binotti *et al.,* 2008). These cultivars are considered vigorous and may provide the highest growth rates during initial period of establishment of the culture (Dutra *et al*. 2007). Coelho *et al*. (2010) observed a positive association between the germination percentage and the primary root, and a negative relation with seed mass. Michels *et al*. (2014) characterizing native bean genotypes about the physiological potential of the seeds produced in different regions of Santa Catarina, concluded that the genotype and environment influenced the physiological quality of bean and that the expression of the potential of each genotype was dependent on favorable conditions in the culture environment.

Conclusion

According to the assessment of the physiological quality of landrace seeds from seed banks of communities settled in Paraiba, we conclude that:

- Padre Cleides rural settlement showed seeds with high viability for production and marketing, expressed by the good values of germination (97%) and vigor (75. 25%).
- 'Porto Rico' variety from Três Irmãos showed a high percentage of germination (100%) but low vigor (51%), indicating the need for renewal of this variety in the seed bank.
- Maize seeds varieties from Frei Damião rural settlement ('Branco' and 'Roxo' varieties) had low physiological quality (germination of 60% and 62%; vigor of 4% and 0%, respectively) in comparison to other varieties. A renewal of the variety and studies of stocking are suggested.
- 'Ligeiro' and 'Costela de Vaca' bean varieties from Padre Cleides and Três Irmãos rural settlements showed high viability for production and marketing.
- 'Azul' bean variety from Padre Cleides settlement had small values of germination (25%) and vigor (8%) and is not suggested for production and marketing. We suggest the replacement of this variety by exchanging seeds with other communities.

REFERENCES

AGRICULTURA FAMILIAR. O Popular, Goiania, n. 845, p.12, 2004. (Suplemento do Campo)

Albarello, E. J.; Silva, M. T. da.; Gorgen, S. Casa de sementes crioulas, Caminho para a Autonomia na Produção Camponesa. Porto Alegre, 2009. INSTITUTO CULTURAL PADRE JOSIMO.

Albucarma, V. M. Avaliação de Variedades de Milho em Sistema de Produção Orgânica- Qualidade Fisiológica e Armazenabilidade das Sementes, Ano de Obtenção: 2008. (dissertação de mestrado- Universidade Estadual do Oeste do Paraná, UNIOESTE-PR.), 2008. 59p.

Almeida, J.; Navarro, Z. (Org.). Reconstruindo a agricultura: ideias e ideais na perspectiva do desenvolvimento rural sustentável. Porto Alegre: UFRGS, P.19-32, 2006.

Almeida, P.; Cordeiro, A. Sementes da Paixão: Estratégia comunitária de conservação de variedades locais no semiárido, 2ª ed. Esperança, p.31-55.2002.

Altieri, M. A. Agroecologia: a dinâmica produtiva da agricultura sustentável. Porto Alegre: Ed. Universidade/UFRGS, 1998. 110p.

Altieri, M. A.; Nicholls, Clara I. Agroecologia: Resgatando a agricultura Orgânica a partir de um modelo industrial de produção e distribuição. Ciência & Ambiente, Santa Maria, v.1, n. 1(jul. 1990), p.141-152, 2003.

Antonello, L. M. Muniz, M. F. B. Brand, S. C. Rodrigues, J. Menezes,N. L.; Kulczynski, S. M. Influência do tipo de embalagem na qualidade fisiológica de sementes de milho crioulo. Revista Brasileira de Sementes, Londrina, v.31, n.4, p.75-86, 2009.

Aosa. Association of Official Seed Analysts. Seed vigor testing handbook. East Lansing, AOSA, 1983. 88p.

Barros, D. I.; Nunes, H. V.; Dias, D. C. F. S.; Bhering, M. C. Comparação entre testes de vigor para avaliação da qualidade fisiológica de sementes de tomate. Revista Brasileira de Sementes, v.24, n.2, p.12-16, 2002.

Batista, J. A. S. (2007).Feijão Canapu. Disponível em: https://www.slowfoodbrasil.com/arca-do-gosto/produtos-do-brasil/119-feijao-canapu. Acesso em: 10 de novembro de 2015.

Binotti, F.F.S.; Haga, K.I.; Cardoso, E.D.; Alves, C.Z.; Sá, M.E.; Arf, O. Efeito do período de envelhecimento acelerado no teste de condutividade elétrica e na qualidade fisiológica de sementes de feijão. Acta Scientiarum. Agronomy, v.30, n.2, p.247-254, 2008.

BRASIL, Ministério da Agricultura, Pecuária e Abastecimento. Regras para Análise de sementes. Secretaria de Defesa Agropecuária, Brasília: Mapa/ACS, 2009. 399 p.

Campos, S. R. F. Moura, W. Pertel, J. Lima, P. C. Aspectos legais da produção e da comercialização de sementes. Informe Agropecuário, Belo Horizonte, v.27, n.232, p.15-21, 2006.

Carpentieri-Pípolo, V. Souza, A. de. Daiana Alves da Silva, D. A. da. Barreto, T. P. Garbuglio, D. D. Ferreira, J. M. Avaliação de cultivares de milho crioulo em sistema de baixo nível tecnológico. Acta Scientiarum. Agronomy. Maringá, v. 32, n. 2, p. 229-233, 2010. Disponível em: http://www.scielo.br/pdf/asagr/v32n2/a07v32n2.pdf.

Carvalho, H. W. L. de. Santos, M. X. dos. Leal, M. L. da. S.Tabosa, J. N. Cardoso, M. J. Carvalho, B. C. L. Lira, M. A. Monteiro, A. A. T. Albuquerque, M. M. Melhoramento genético de milho no Nordeste brasileiro. Recursos Genéticos e Melhoramento de Plantas para o Nordeste Brasileiro. 1998 Disponível em: http://www.cpatsa.embrapa.br/catalogo/livrorg/milhonordeste.pdf.

Carvalho, H. W. L. de. Silva Leal, M. de. L. S. Santos, M. X. Monteiro, A. A. T. Cardoso, M. J. Carvalho, B. C. L. de. Estabilidade de cultivares de milho em três ecossistemas do nordeste brasileiro. Pesq. agropec. bras. vol.35 no.9 Brasília Set. 2000. Disponível em: http://www.scielo.br/ scielo.S0100-204X2000000900010.

Carvalho, N.M.; Nakagawa, J. Sementes: Ciência, Tecnologia e produção. 4ed. Jaboticabal: FUNEP, 2000. 588p.

Catão, H. C. R.M; Costa, F. M; Valadares, S. V; Dourado, E. da. R; Brandão Junior, D. S; Sales, N. de. L. P. Qualidade física, fisiológica e sanitária de sementes de milho crioulo produzidas no norte de Minas Gerais. Cienc. Rural v.40 n.10 Santa Maria Out 2010. Disponível em: http://www.scielo.br/scielo S0103-84782010001000002.

Coelho, M. M.; Mota, M. R.; Souza, D. J. M. Potencial Fisiológico em Sementes de cultivares de Feijão Crioulo (*Phaseolus vulgaris* L.).Revista Brasileira de Sementes, vol. 32, nº 3 p.097-105, 2010.

COSTA, R. Q.; MOREIRA, G. L. P.; SOARES, M. R. S.; VASCONCELOS, R. C.; MORAIS, O. M. Qualidade fisiológica de sementes de milho crioulo e comerciais semeadas na Região Sudoeste da Bahia. Enciclopédia Biosfera, Goiânia, v.9, n.16, p.1873-1880, 2013.

Cruz, J. C. Konzen, E. A. Pereira Filho, I. A. F. Marriel, I. E. Cruz, I. Duarte, J. de. O. Oliveira, M. F. Alvarenga, R. C. Produção de milho orgânico na agricultura familiar. Circular Técnico 81. Embrapa Sete Lagoas MG. 2006.

Didonet, A. D. Produção comunitário de sementes: segurança alimentar, desenvolvimento sustentável e cidadania. Santo Antônio de Goiás: Embrapa Arroz e Feijão, 2007 16 p. (Documentos/Embrapa Arroz e Feijão, ISSN 1678-9644, 213).

Doebley, J. F. Molecular evidence for gene flow among Zea species. BioScience, v. 40, p. 443-448, 1990.

Dutra, A. S.; Teófilo, E. M.; Medeiros Filho, S.; Dias, F. T. C. Qualidade fisiológica de sementes de feijão caupi em quatro regiões do estado do Ceará. Revista Brasileira de Sementes, Londrina, v.29, n.2, p.111-116, 2007.

EMBRAPA MEIO-NORTE. Cultivo de feijão caupi. Jul/2003. Disponível em: <http://www.cpamn.embrapa.br/pesquisa/graos/FeijaoCaupi/referencias.htm>. Acesso em: 16 Nov. 2013.

ENCICLOPÉDIA BIOSFERA, Centro Científico Conhecer - Goiânia, v.9, N.16; p.1873-1880. 2013.

Fancelli, L.; Dourado Neto, .D. Produção de milho. Guaíba: Agropecuária, 2000. 360p.

Feijão Canapu. Disponível em: <http://www.slowfoodbrasil.com/arca-do-gosto/produtos-do-brasil/119-feijao-canapu>. Acesso em: 02 de Nov. 2014.

Ferreira, D. F. SistemaSISVAR para análises estatísticas: Manual de orientação. Lavras: Universidade Federal de Lavras/Departamento de Ciências Exatas, 2000. 37p.

Ferreira, H. A. Souza, A. S. Sousa, D. A. Maracajá, P. B. Componentes de produção e produtividade do milho submetido a doses de nitrogênio no semiárido Paraibano. Revista Verde (Mossoró – RN – Brasil) v.5, n.4, p. 90 – 96, 2010.

Freire Filho *et al*. Feijão-caupi no Brasil: Produção, Melhoramento Genético, Avanços e Desafios. Teresina: Embrapa Meio-Norte, 2011, 84p.

Gliessman, Stephen R. Agroecologia: processos ecológicos em agricultura sustentável. Porto Alegre: Editora da UFRGS, 2005. 653 p.

Haesbaert, F.M. Testes para análise de vigor em sementes de girassol. Universidade federal de Santa Maria (dissertação de mestrado), 2013, 70p.

IBGE- Estatística da Produção Agrícola Setembro de 2013. Disponível em: http://www.ibge.gov.br/home/estatistica/indicadores/agropecuaria/lspa/estProdAgr_201309.pdf. 19 Fev. 2014.

Lima R. C. Mello, L. M. M. Carvalho. M. P. Lima, C. G. R. Mello, A. M. Aspectos lineares e espaciais da correlação entre a produtividade de forragem de milho e a porosidade do solo sob plantio direto. eng.agríc. vol.29 no.1 Jaboticabal jan./mar. 2009.

Lima, C. J. G. S. *et al*. Resposta do feijão caupi a salinidade da água de irrigação. Revista Verde Agroecologia Desenvolvimento Sustentável, Mossoró, v.2, n.2, p.79-86, 2007. FREIRE FILHO et., al. Feijão-caupi no Brasil: Produção, Melhoramento Genético, Avanços e Desafios. Teresina: Embrapa Meio-Norte, 2011, 84 p.

Lima, V.J.; Souza, P.Y.; Sousa, L.R.; Junior, S.P.B.J.; Junior, F.P.S,; Teste de germinação de sementes de milho crioulo de comunidades rurais da região do Cariri Cearense. IV Encontro Universitário da UFC no Cariri. 2012 Universidade Federal do Ceará - Campus Juazeiro do Norte-CE, 17 a 19 de Dezembro de 2012.

Loarce, Y.; Gallego, R.; Ferrer, E. A comparative analysis of the genetic relationship between rye cultivar using RFLP and RAPD markers. Euphytica, Wageningen, v. 88, n. 2, p. 107-115, 1996.

Marcos Filho, J. Fisiologia de sementes de plantas cultivadas. Piracicaba: FEALQ. 495p. 2005.

Marcos Filho, J. Testes de vigor: Importância e utilização. IN: KRZYANOWSKI, F.C.; VIEIRA, R.D.; FRANÇA (Ed.). Vigor de sementes: conceitos e testes. Londrina: ABRATES, 1999a. Cap.1. p.1-21.

Marcos Filho, J.;Cicero,S.M.;Silva,W.R. Avaliação da qualidade das sementes. Piracicaba: FEALQ, 1987.230 p.

Matos, M. J. L. F.; Tavares, S. A.; Santos, F. F. dos; Melo, M. F. de; Lana, M. M. Milho verde. 2006. Disponível em: http://www.cnph.embrapa.br/paginas/dicas_ao_consumidor/milo_verde.htm. Acesso em 14 de Out.2014.

Medeiro Filho, S.; Teófilo, E. M. Tecnologia de produção de sementes, In: Freire Filho, F. R.; Lima, J. A. A.; Ribeiro, V,Q, (Ed,), Feijão-caupi: avanços tecnológicos, Brasília: EMBRAPA, 2005, cap.13. p 487-497.

Michels, A. F.; Souza, C. A.; Medeiros, C. M.C.; Zilio, M. Qualidade fisiológica de sementes de feijão crioulo produzidas no oeste e planalto catarinense. Rev. Ciênc. Agron., v. 45, n. 3, p. 620-632, jul.-set, 2014.

Moretto, E.; Fett, R. Tecnologia de óleos e gorduras vegetais na indústria de alimentos. São Paulo: Livraria Varela, 1998.

Motta, M.; Zarth, P. introdução. In: Motta, M; Zarth, p. (org). Formas de Resistencia c Camponesa : visibilidade e diversidade de conflitos ao longo da história .São Paulo: Ed Unesp/ Brasília: MDA/NEAD, 2008. (coleção História Social do Campesinato no Brasil).

Nakagawa, J. Testes de vigor baseado no desempenho das plântulas. In :Krzyzanowski, F.C.;Vieira,R.D.; França Neto, J.B.(Ed.). Vigor de sementes: conceitos e testes. Londrina: ABRANTES,1999. cap.2 p.2.1-2.24.

Nazzari, R. K. *et al*. Organização de Geysler Flor Bertolini, Lorene Terezinha Brandalise. Gestão das unidades artesanais na agricultura familiar: uma experiência no Oeste do Paraná. 2. ed. – Cascavel: EDUNIOESTE, 2010.

Neto, J.B.F. (Editores). Vigor em sementes: Conceitos e testes. Londrina. ABRATES, 1999, P. 1.1-.1.21.

Pádua, G.P. Vigor de sementes e seus possíveis efeitos sobre a emergência em campo e a produtividade. Informativo ABRATES, Londrina. V.8, n1/2/3, dezembro, 1998.

Paes ,M.C.D. Aspectos Físicos, Químicos e Tecnológicos do Grão de Milho. Embrapa, Circular Técnico, n.75. 2006.

Paterniani , E..; Nass, L.L.; Santos, M. X. dos. O valor dos recursos genéticos de milho para o Brasil- uma abordagem histórica da utilização do germoplassma. In: UDRY, C.V;

DUARTE, W. Uma história brasileira do milho – o valor dos recursos genéticos/Consolatión Villa fane Udry & Wilton Duarte (org.) - Brasília: Paralelo 14, 2000. 136p.

Popinigis, F. Controle de qualidade de sementes. In: CONGRESSO BRASILEIRO DE SEMENTES, 4., 1985, Brasília. Fisiologia da semente. Brasília: AGIPLAN, 1985. p.157. 289p.

Portugal, Duque Alberto. O desafio da agricultura familiar. 2004. Disponível em http://www.embrapa.br/imprensa/artigos/2002/artigo.2004-12-07.2590963189/ >. Acesso em 12 de Out. 2014.

Prolla, I. Características físico-químicas de cultivares de feijão e efeitos biológicos da fracção fibra solúvel. Dissertação de mestrado, Universidade Federal de santa Maria, 2006.

Rocha, G. P.; Silva, N. C; Dourado, E. R.; Teixeira, M. da S.; Junior, D. B. Bramdão, G. S. Qualidade fisiológica de sementes de milho (Zea mays) e Sorgo (Sorghum bicolor) crioulos produzidas nos campos de sementes de agricultores (as) familiares de Porteirinha, Norte de Minas Gerais. Revista Brasileira de Agroecologia, v. 4, n. 2, 2009.

Rolin, R. R.; Freitas Júnior, S. P.; Brito, M.C.B.; Aquino, R. L.; Lucena, R.G. Avaliação da Qualidade Fisiológica de Sementes de Milho Crioulo Através do Teste de Germinação e Condutividade Elétrica. IV Encontro Universitário da UFC no Cariri. 2012 Universidade Federal do Ceará - Campus Juazeiro do Norte-CE, 17 a 19 de Dezembro de 2012.

Sandri, C. A. Tofanelli, M. B. D. Milho crioulo: uma alternativa para rentabilidade no campo. Pesquisa Agropecuária Tropical, 2008, Vol.38(1), p.59. Disponível em: http://www.periodicos.capes.gov.br.

Romano, M. R.Andrade, J. M. de. Rocha, C. H. Verburg, N. Desempenho de cinco variedades de milho crioulo em diferentes sistemas de produção Resumos do V CBA - Manejo de Agroecossistemas Sustentáveis Rev. Bras. de Agroecologia/out. 2007 Vol.2 No.2. Disponível em: http://www.aba-agroecologia.org.br.

Santos, A. Leite, J. Silva. E. Lima, W. Araujo, S. L. Silva, M. J. Avaliação participativa de ensaio com variedades de milho crioulo no município de Casserengue-PB. IX congresso da sociedade brasileira de sistemas de produção (IX CSBSP)- 2004. ciência, tecnologia e inovação para o desenvolvimento rural sustentável. Disponível em: www.alice.cnptia.embrapa.acesso em 19 de Set de 2014.

Santos, A. S *et al*. Pesquisa política de sementes no semiárido paraibano: relatório Embrapa tabuleiros costeiros. Aracaju. p 60. 2012.

Santos, et., al. Novas variedades de caupi para a microrregião do Brejo Paraibano. Tecnol. & Ciên. Agropec. João Pessoa, v.3, n.3, p.07-12, set. 2009.

Santos, Milton. A natureza do espaço: técnica e tempo, razão e emoção. 3ªed. São Paulo: Hucitec, 1999. 308p.

Toledo, T. C. F.; Canniatti-Brazaca, S. G. Avaliação química e nutricional do feijão carioca (Phaseolus vulgaris L.) cozido por diferentes métodos. Ciência e Tecnologia de Alimentos, 28, 355-360, 2008.

Trindade, C. C.; Sementes Crioulas e Transgênicas, uma reflexão sobre sua relação com as comunidades tradicionais. In: XV Congresso Nacional do Conpedi, Manaus, 2006.

Veiga, J. E.; Favareto, A. A.; Azevedo, C.M.A.; Bittencourt, G.; Vecchiatti, K.; Magalhães, R.; Jorge, R. O Brasil Rural Precisa de uma Estratégia de Desenvolvimento. Brasília: Convênio FIPE-IICA (MDA/CNDRS/NEAD) 2001. 108 p.

Vieira, R. D.; Carvalho, N. M.; Sader, R. TESTES DE VIGOR E SUAS POSSIBILIDADES DE USO. IN: Vieira, R. D.; Carvalho, N. M. (ed.). Testes de vigor em sementes. Jaboticabal: UNESP/FUNEP, cap.2, p.31-47, 1994.

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