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Seasonality Calendar for Non-Conventional or Neglected Horticultural Crops

Calendário de Sazonalidade de Hortifrutícolas Não Convencionais ou Negligenciadas

Abstract

Introduction: With a huge variety of edible plants, native or exotic, Brazil's biodiversity is underexploited as far as food is concerned. **Objective:** To develop a Seasonality Calendar to promote further knowledge, use and preservation of these species that make up Brazil's biodiversity. **Methods:** Systematization of information about the harvest period of unconventional or neglected horticultural products, through a review of the scientific literature, by classifying them according to the parts used in human nutrition, such as fruits, fruit-vegetables, herbaceous vegetables and seeds. **Results:** The calendar includes 71 species, classified into 60 native and 11 exotic ones, subdivided into 59 fruits, 3 fruit-vegetables, 13 herbaceous vegetables and 6 seeds. **Conclusions:** There need to be more studies focused on this topic owing to its relevance and scarcity of works that present easily applicable tools to encourage the use of unconventional or neglected horticultural crops in cuisine and gastronomy. Therefore, the population and, especially, culinary professionals (when planning menus) are expected to use this knowledge with a view to valuing food culture and the conservation of Brazilian biodiversity.

Keywords: Fruits. Vegetables. Biodiversity. Food Plants. Harvest.

Resumo

Introdução: Com uma enorme variedade de plantas comestíveis, nativas ou exóticas, o Brasil tem sua biodiversidade subexplorada na alimentação. **Objetivo:** Desenvolver um Calendário de Sazonalidade, a fim de contribuir para o conhecimento, uso e preservação dessas espécies que compõem a biodiversidade. **Métodos:** Sistematização de informações sobre o período de safra de hortifrutícolas não convencionais ou negligenciadas, por meio de revisão da literatura científica, classificando-as de acordo com as partes utilizadas na alimentação humana, como frutas, hortaliças-fruto, hortaliças herbáceas e sementes. **Resultados:** O calendário contempla 71 espécies, classificadas em 60 nativas e 11 exóticas, subdivididas em 59 frutas, 3 hortaliças-fruto, 13 hortaliças herbáceas e 6 sementes. **Conclusão:** A relevância do tema e a escassez de trabalhos que apresentem ferramentas de fácil aplicação, que propiciem a adoção de hortifrutícolas não convencionais ou negligenciadas na culinária e gastronomia, ressaltam a importância de mais estudos voltados para esta temática. Almeja-se, dessa forma, que o calendário proposto seja utilizado pela população e, sobretudo, por profissionais dos serviços de alimentação no planejamento dos cardápios, visando a valorização da cultura alimentar e preservação da biodiversidade brasileira.

Palavras-chave: Frutas. Hortaliças. Biodiversidade. Plantas Comestíveis. Safra.

INTRODUCTION

The Convention on Biological Diversity recognizes the relationship between biodiversity, agriculture and nutrition, and specialists have been advocating inclusion of greater agricultural biodiversity in public policies and practices, aiming at food and nutritional security.¹⁻³ Brazil is one of the most biodiverse countries in the world, with more than 40 thousand different species of plants.⁴ According to Beltrame et al.,⁵ although part of the native diversity is used, such as manioc, passion fruit and açaí, most species with nutritional and economic potential, remain unexplored.

Many of the components of agrobiodiversity depend on human activity, because everything that is not used, cultivated, stored, studied, sold and consumed, may become endangered. The project *Biodiversity for Food and Nutrition* (BFN), an initiative led by Brazil, Kenya, Sri Lanka and Turkey, and funded by *Global Environment Facility*, used several biodiversity conservation strategies, including the promotion of the use of native species in national food and nutrition policies, research institutions, school curricula, indigenous communities, and also by famous chefs.^{5,6} However, agricultural efforts to produce large quantities of few basic but energy-rich crops, such as corn, wheat and rice, have led many nutritious species to gradually disappear from the population's diet and to fall into agricultural neglect, leading to enormous losses in the diversity of available foods.⁷

In Brazil, consumption of fruits and vegetables has been estimated at only 3.7% of total calories.⁸ Furthermore, the variety of these foods, found in the population's diet, is influenced by several factors, e.g., seasonality, which is affected by regional and climatic specificities, in addition to food preferences, and prices, which can modify access to certain horticultural crops.⁹

Several HC and other edible plants, native or exotic, spontaneous or cultivated, which are not included in the daily diet of the population, are also called "unconventional". The species that fall under this concept are those that have not yet received due attention from the technical-scientific community, nor from society as a whole. As a result, consumption of such species is occasional and takes place in some particular regions; moreover, it has great influence on the food and culture of traditional populations, and is hardly found in the other areas of the country. In addition to being crops that are not organized as a productive chain *per se*, unlike conventional vegetables (potatoes, tomatoes, cabbage and lettuce), they do not arouse interest on the part of food manufacturers and companies producing seeds, fertilizers, and agrochemicals.¹⁰ These fruits and vegetables are currently marginalized, but they express Brazilian biodiversity and are underexplored sources of nutrients and bioactive compounds that offer not only positive health effects, but also flavors and aromas that are unknown to the population,^{11,12} which need to be explored and used further, thereby recovering knowledge about ways of cultivation, management, seasonality, post-harvest conservation and use in cooking.

The harvest season is one of the requirements to be considered when menus are planned, because there is maximum production of HC in this period, with a lower price, in addition to higher quality and more flavor. Santos et al.,¹³ defined harvest as the productive period in which adequate and ideal conditions for production are in place. The development of plants is divided into two phases: the first, called the vegetative phase, begins with seed germination, and continues until the plant is fully grown. The second, called the reproductive phase, goes from the beginning of flowering to the formation of fruits and seeds, recognized as the harvest period.¹⁴ These periods of ideal conditions are called seasonality, which are fluctuations that occur once a year and are repeated annually.¹⁵

Considering the Brazilian food consumption pattern, and the need to value biodiversity as a raw material for cuisine and healthy eating, a seasonality calendar for non-conventional or neglected horticultural crops (NCHC) was developed, based on scientific records. It identifies the harvesting period of these foods in order to support, encourage and promote the use of NCHC in cuisine and gastronomy. It should be noted that initiatives and studies that support, encourage and promote the consumption of native HC, which do not use land exploitation and soil

depletion in the production method, are relevant to Brazilian food sovereignty and to the preservation of the environment and biodiversity.

MATERIALS AND METHODS

This is a review of the knowledge available in the literature, based on scientific publications from the following databases: Portal Periódicos - Capes, *Web of Science* (ISI), *Scopus*, *ScienceDirect*, Academic Google (*Scholar Google*), *SciELO*, as well as publications and technical communications from Brazilian research institutions, and books on the subject with systematic indexes: Brazil, fruits, botany, trees, unconventional food plants and native fruits. The bibliographic search was carried out from April to June 2019 and the following descriptors, isolated or combined, were used: phenology, reproductive phenology, phenological study, tropical forest, Atlantic Forest, flowering, fruiting, seedling production, Brazil. This review included articles and books published in Portuguese and English, regardless of year of publication. Studies were excluded when they did not mention the period of fruiting, or flowering, or seasonality of horticultural crops in use.

The development of the seasonality calendar only included NCHC classified as perennial plants and with some edible part that presented seasonal cycles. Herbaceous vegetables such as Barbados gooseberry, cocoyam, creeping woodsorrel, purslane and lamb's-ear were not included in the seasonality calendar for neglected or unconventional horticultural crops, as they did not meet the inclusion criteria used in the study. The leaves, which are its main edible parts, do not have seasonal cycles.

Horticultural crops were considered as unconventional, that is, they are not inserted in the large commercialization chains, when recognized as such by the specialized literature,^{10,16,17} and they were not present in the 2015-2019 harvest table of the Companhia de Entrepósitos e Armazéns Gerais de São Paulo (CEAGESP). CEAGESP was used as a reference because it is considered the largest wholesale market for horticultural crops in Latin America.¹⁸

Owing to the large number of species included, it was methodologically necessary to show the botanical similarities and differences between these horticultural crops. The criteria consisted in grouping by common characteristics, and dividing by classification of the parts used in human nutrition. After unconventional or neglected horticultural crops were selected, they were classified into: fruits, fruit-vegetables, herbaceous vegetables and seeds. To present the similarities, the calendar contains the following information: popular name, scientific name, origin, classification according to its edible parts and months of harvest, or greater harvest, indicated as "strong", and the other months, indicated as "weak", assuming the possibility of small harvests in this period.⁶

RESULTS AND DISCUSSION

Twelve scientific records were selected, among articles and books, which included the information necessary for research on seasonality. A large part of the works reviewed was related to the description of phenology and production of seedlings and species, published in journals in the field of botany and agronomy, or in botany treatises, with the gathering of a large number of plant species, as shown in Table 1. The seasonality calendar was designed on the basis of the harvest period mentioned in these scientific records.

Table 1. Review of the knowledge available in the literature on non-conventional or neglected horticultural crops in terms of seasonality.

AUTHOR AND YEAR	LOCATION	OBJECTIVE	SELECTED FRUITS AND VEGETABLES
Cavalcante PB, 1976 ¹⁹	Belém, PA	To taxonomically and agronomically present the characteristics of edible fruits from the Brazilian Amazon.	Uxicuruá (<i>Duckesia verrucosa</i> (Ducke) Cuatrec.).
Cavalcante PB, 1979 ²⁰	Belém, PA	To taxonomically and agronomically present the characteristics of edible fruits from the Brazilian Amazon.	Sapota (<i>Matisia cordata</i> Kunth).
Lorenzi H, 1992 ²¹	São Paulo, SP	Disseminate knowledge of Brazilian forest species and give advice on their cultivation.	Bocaiuva (<i>Acrocomia aculeata</i> (Jacq.) Lodd. ex Mart.); Guariroba (<i>Syagrus oleracea</i> (Mart.) Becc.); Jarivá (<i>Syagrus romanzoffiana</i> (Cham.) Glassman); Ipê-amarelo (<i>Handroanthus chrysotrichus</i> (Mart. ex DC.) Mattos); Ipê-branco (<i>Tabebuia roseoalba</i> (Ridl.) Sandwith); Mamoeiro-bravo (<i>Jacaratia spinosa</i> (Aubl.) A.DC.); Oiti (<i>Licania tomentosa</i> (Benth.) Fritsch); Baru (<i>Dipteryx alata</i> Vogel); Corticeira-serrana (<i>Erythrina falcata</i> Benth.); Monguba (<i>Pachira aquatica</i> Aubl.); Jenipapo (<i>Genipa americana</i> L.).
Jardim MAG, Stewart PJ, 1994 ²²	Belém, PA	Disseminate scientific knowledge and collections on natural and socio-cultural systems related to the Amazon.	Tucumã (<i>Astrocaryum aculeatum</i> G. Mey.).
Lorenzi H, 1998 ²³	São Paulo, SP	Disseminate knowledge of Brazilian forest species and give advice on their cultivation.	Cumarú-do-amazonas (<i>Dipteryx odorata</i> (Aubl.) Willd.); Umari (<i>Poraqueiba sericea</i> Tul.); Mapati (<i>Pourouma cecropiifolia</i> Mart.).
Zamith LR, Scarano FR, 2004 ²⁴	Rio de Janeiro, RJ	Evaluate the feasibility of producing seedlings of native species of Restinga in a nursery.	Bacuri (<i>Garcinia brasiliensis</i> Mart.); Aroeira (<i>Schinus terebinthifolius</i> Raddi).
Reys P, Galetti M, Morellato LPC, Sabino J, 2005 ²⁵	Campinas, SP	Understand the variation in reproductive phenology and fruit availability of tree species in riparian forests of the Formoso river, municipality of Bonito, Mato Grosso do Sul, between seasons and over a year.	Guanandi (<i>Calophyllum brasiliense</i> Cambess.); Mutamba (<i>Guazuma ulmifolia</i> Lam.).
Shanley P, Medina G, 2005 ²⁶	Belém, PA	Contribute scientifically with information on the fruits of the Amazon rainforest in the State of Pará, in addition to contributing to popular culture and knowledge of the forest.	Cajá-manga (<i>Spondias dulcis</i> Parkinson); Taperebá (<i>Spondias mombin</i> L.); Pupunha (<i>Bactris gasipaes</i> Kunth); Açaí (<i>Euterpe oleracea</i> Mart.); Buriti (<i>Mauritia flexuosa</i> L. f.); Bacaba (<i>Oenocarpus bacaba</i> Mart.); Patauá (<i>Oenocarpus bataua</i> Mart.); Pequiá (<i>Caryocar villosum</i> (Aubl.) Pers.); Uixi (<i>Endopleura uchi</i> (Huber) Cuatrec.).

Table 1. Review of the knowledge available in the literature on non-conventional or neglected horticultural crops in terms of seasonality. (Continuesd)

Pereira TS, Costa MLMN, Moraes LFD, Luchiari C, 2008 ²⁷	Porto Alegre, RS	To characterize the phenology of tree species representative of the forest in the Poço das Antas Biological Reserve to offer information for the management of the most suitable species for the endangered local fauna.	Juçara (<i>Euterpe edulis</i> Mart.); Ingá-doce (<i>Inga edulis</i> Mart.).
Lorenzi H, 2009 ²⁸	São Paulo, SP	Disseminate knowledge of Brazilian forest species and give advice on their cultivation.	Mandacaru (<i>Cereus hildmannianus</i> K. Schum.); Mamorana (<i>Pachira insignis</i> (Sw.) Savigny).
Vieira RF, Costa TSA, Silva DB, Ferreira FR, Sano SM, 2010 ²⁹	Brasília, DF	Identify species of flora from the Midwest region, of current or potential economic importance, for direct use and/or increased commercial use.	Pequi (<i>Caryocar brasiliense</i> Cambess.).
Lorenzi H, Lacerda M, Bacher L, 2015 ¹⁶	São Paulo, SP	Describe the morphological characteristics, origin, time of flowering and fruiting, forms of use and propagation of fruits grown in Brazil.	Pepino-do-mato (<i>Ambelania acida</i> Aubl.); Umbu (<i>Spondias tuberosa</i> Arruda); Sapucaia (<i>Lecythis pisonis</i> Cambess.); Araticum-açú (<i>Annona montana</i> Macfad.); Biribá (<i>Annona mucosa</i> Jacq.); Cumã (<i>Couma utilis</i> (Mart.) Mull. Arg.); Pajurá (<i>Couepia bracteosa</i> Benth.); Ingá-mari (<i>Cassia leiandra</i> Benth.); Cafezinho (<i>Bunchosia armeniaca</i> (Cav.) DC.); Muruci (<i>Byrsonima crassifolia</i> (L.) Kunth); Macambo (<i>Theobroma bicolor</i> Bonpl.); Cacao (<i>Theobroma cacao</i> L.); Capuí (<i>Theobroma subincanum</i> Mart.); Fruta-pão (<i>Artocarpus altilis</i> (Parkinson) Fosberg); Jaca-de-macaco (<i>Artocarpus lakoocha</i> Wall. ex Roxb.); Sete-capotes (<i>Campomanesia guazumifolia</i> (Cambess.) O. Berg); Cambuci (<i>Campomanesia phaea</i> (O. Berg) Landrum); Jatobá (<i>Hymenaea courbaril</i> L.); Abriçó (<i>Mammea americana</i> L.); Guariroba-rugosa (<i>Campomanesia schlechtendaliana</i> (O. Berg) Nied.); Araçá-boi (<i>Eugenia stipitata</i> McVaugh); Guaibila (<i>Eugenia victoriana</i> Cuatrec.); Camu-camu (<i>Myrciaria dubia</i> (Kunth) McVaugh); Araçanduba (<i>Psidium acutangulum</i> DC.); Jambo (<i>Syzygium malaccense</i> (L.) Merr. & L.M. Perry); Biri-biri (<i>Averrhoa bilimbi</i> L.); Maracujá-vermelho (<i>Passiflora caerulea</i> L.); Maracujá-rajado (<i>Passiflora coccinea</i> Aubl.); Maracujá-do-mato (<i>Passiflora nitida</i> Kunth); Maracujá-melão (<i>Passiflora quadrangularis</i> L.); Uva-do-japão (<i>Hovenia dulcis</i> Thunb.); Cacaú (<i>Theobroma speciosum</i> Willd. ex Spreng.); Néspole (<i>Mespilus germanica</i> L.); Lima-vermelha (<i>Citrus limetta</i> Risso); Groselha-do-ceilão (<i>Dovyalis hebecarpa</i> (Gardner) Warb.); Pitomba (<i>Talisia esculenta</i> (A.St.-Hil.) Radlk.).

In the literature and in the technical field, there is some confusion regarding the names of the fruit and vegetables that are the object of this study. Sometimes they are identified as “Neglected”, or “Underutilized”, and there is still a group of technicians that calls them “Traditional”. Calling them traditional horticultural products, in reference to their cultivation, associated with traditional populations, is also a way of valuing the cultural issue added to these species. However, it can cause confusion by alluding them to the most commonly consumed vegetables such as potatoes, tomatoes and lettuce.¹⁰ Therefore, in this publication, the term “unconventional” or “neglected” is used.

The classification of NCHC used in the present study was based on the parts used in human nutrition. Bevilacqua³⁰ classified them into fruit-vegetables, for those that use the fruit, green or ripe, all or in part, such as peppers, okra, peas, tomatoes, scarlet eggplant, eggplant and pumpkin; herbaceous vegetables, for those whose usable parts are above the ground, such as leaves, stems and stems, in addition to flowers and inflorescences; fruits and seeds.

The calendar includes a total of 71 species of NCHC, classified into 60 native and 11 exotic species, subdivided into 59 fruits, 3 fruit-vegetables, 13 herbaceous vegetables and 6 seeds. Some vegetables appear in more than one subdivision, as they have more than one edible part. Figure 1 shows the calendar designed on the basis of the review of the literature.

Native plants are species that have been evolving in a particular environment since remote times, without the interference of humans. The so-called exotic species are those that are in a different environment from their place of origin, owing to human action, either intentional or accidental.³¹ However, some of the exotic species are also considered to be naturalized, that is, species outside their original environment, but which are able to form a population and live with the native community, without interfering in the natural ecosystem.³¹

The instrument developed for the NCHC is broad and diverse when compared to the calendars of supply centers; however, they are still very simple when compared to Brazil's vast agrobiodiversity. The marketing calendar for Supply Centers of the State of Rio de Janeiro (CEASA RJ) presents 26 fruits, 12 fruit-vegetables, 7 herbaceous vegetables, whose diversity is very similar to the calendar of Paraná state's Supply Centers (CEASA PR), which includes 30 fruits, 11 fruit-vegetables and 11 herbaceous vegetables. CEAGESP's calendar has a different classification that includes fruits, vegetables, miscellaneous, flowers and fish. However, it was the calendar that showed the greatest diversity of non-conventional horticultural crops, with 83 fruits, including: abiu, jackfruit, jaboticaba (Brazilian grape), jocote, physalis, pitaya, kumquat and sapodilla; 42 vegetables and 37 vegetables.

Fresh or minimally processed foods, in great variety, and predominantly of vegetable origin, are the basis for a nutritionally balanced, tasty, culturally appropriate diet, for promotion of a socially and environmentally sustainable food system. One of the ten steps to an adequate and healthy diet, as advised by the Dietary Guidelines for the Brazilian Population, is to have fresh or minimally processed food as the basis of one's diet.³²

The well-balanced diet with fruits and vegetables ensures the adequate intake of most micronutrients, fibers and bioactive compounds. In addition, increased consumption of such elements can help replace foods that have high concentrations of saturated fats, sugar and salt.^{32,33} When planning menus, both individually and collectively, the use of seasonal fruits and vegetables should be prioritized, especially in view of their flavor, offer and price. The national school meal program also calls for respect for the local food culture and recommends that menus should be based on sustainability, seasonality and agricultural diversification in Brazil's particular regions.³⁴

Strong cumulative evidence demonstrates that habitual consumption of HC is beneficial to health as they are sources of essential nutrients and bioactive compounds. Maintenance of the microbiota, reduction of inflammation and improvement in immune function, in addition to potential preventive effects in various states of chronic non-

transmissible diseases (CNCD), justify public policies that promote the increase in the consumption of HC as dietary interventions. Current evidence suggests that 800 g of HC per day has stronger effects for prevention of CNCD.³⁵

Therefore, food seasonality calendars are essential tools to assist in planning healthy and sustainable menus. The inclusion of NCHC may contribute to the diversity of HC in the diet and contribute to the expansion of their cultivation.

Figure 1. Seasonality calendar for unconventional or neglected horticultural products

Horticultural crops		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FRUITS	Abricó <i>Mammea americana</i> L. E												
	Açaí <i>Euterpe oleracea</i> Mart. N												
	Araçá-boi <i>Eugenia stipitata</i> McVaugh N												
	Araçanduba <i>Psidium acutangulum</i> DC. N												
	Araticum-açú <i>Annona montana</i> Macfad. N												
	Bacaba <i>Oenocarpus bacaba</i> Mart. N												
	Bacuri <i>Garcinia brasiliensis</i> Mart. N												
	Biri-biri <i>Averrhoa bilimbi</i> L. E												
	Biribá <i>Annona mucosa</i> Jacq. N												
	Bocaiuva <i>Acrocomia aculeata</i> (Jacq.) Lodd. ex Mart. N												
	Buriti <i>Mauritia flexuosa</i> L. f. N												
	Cacau <i>Theobroma cacao</i> L. N												
	Cacaúí <i>Theobroma speciosum</i> Willd. ex Spreng. N												
	Cafezinho <i>Bunchosia armeniaca</i> (Cav.) DC. E												
	Cajá-manga <i>Spondias dulcis</i> Parkinson N												
	Cambuci <i>Campomanesia phaea</i> (O. Berg) Landrum N												
	Camu-camu <i>Myrciaria dubia</i> (Kunth) McVaugh N												
	Capuí <i>Theobroma subincanum</i> Mart. N												
	Cumã <i>Couma utilis</i> (Mart.) Mull. Arg. N												
	Fruta-pão <i>Artocarpus altilis</i> (Parkinson) Fosberg E												
Groselha-do-ceilão <i>Dovyalis hebecarpa</i> (Gardner) Warb. E													
Guaibila <i>Eugenia victoriana</i> Cuatrec. N													
Guanandi <i>Calophyllum brasiliense</i> Cambess. N													

Figure 1. Seasonality calendar for unconventional or neglected horticultural products (Continued)

Horticultural crops		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FRUITS	Guariroba N <i>Syagrus oleracea</i> (Mart.) Becc.												
	Guariroba-rugosa N <i>Campomanesia schlechtendaliana</i> (O. Berg) Nied.												
	Ingá-doce N <i>Inga edulis</i> Mart.												
	Ingá-mari N <i>Cassia leiandra</i> Benth.												
	Jaca-de-macaco E <i>Artocarpus lakoocha</i> Wall. ex Roxb.												
	Jambo E <i>Syzygium malaccense</i> (L.) Merr. & L.M. Perry												
	Jatobá N <i>Hymenaea courbaril</i> L.												
	Jenipapo N <i>Genipa americana</i> L.												
	Jerivá N <i>Syagrus romanzoffiana</i> (Cham.) Glassman												
	Juçara N <i>Euterpe edulis</i> Mart.												
	Lima-vermelha E <i>Citrus limetta</i> Risso												
	Macambo E <i>Theobroma bicolor</i> Bonpl.												
	Mamoeiro-bravo N <i>Jacaratia spinosa</i> (Aubl.) A. DC.												
	Mandacaru N <i>Cereus hildmannianus</i> K. Schum.												
	Mapati N <i>Pourouma cecropiifolia</i> Mart.												
	Maracujá-do-mato N <i>Passiflora nitida</i> Kunth												
	Maracujá-melão N <i>Passiflora quadrangularis</i> L.												
	Maracujá-rajado N <i>Passiflora coccinea</i> Aubl.												
	Maracujá-vermelho N <i>Passiflora caerulea</i> L.												
	Murici N <i>Byrsonima crassifolia</i> (L.) Kunth												
Néspole E <i>Mespilus germanica</i> L.													
Oiti N <i>Licania tomentosa</i> (Benth.) Fritsch													
Pajurá N <i>Couepia bracteosa</i> Benth.													

Figure 1. Seasonality calendar for unconventional or neglected horticultural products (Continued)

Horticultural crops		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FRUITS	Patauá <i>Oenocarpus bataua</i> Mart. N	Strong	Strong	Strong	Weak	Weak	Weak	Strong	Strong	Strong	Weak	Weak	Strong
	Pequi <i>Caryocar brasiliense</i> Cambess. N	Strong	Strong	Weak	Weak	Weak	Strong						
	Pequiá <i>Caryocar villosum</i> (Aubl.) Pers. N	Weak	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Pitomba <i>Talisia esculenta</i> (A.St.-Hil.) Radlk. N	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Sapota <i>Matisia cordata</i> Kunth N	Weak	Strong	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Sete-capotes <i>Campomanesia guazumifolia</i> (Cambess.) O.Berg N	Weak	Weak	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Taperebá <i>Spondias mombin</i> L. N	Weak	Weak	Strong	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak
	Tucumã <i>Astrocaryum aculeatum</i> G. Mey. N	Strong	Strong	Strong	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak
	Uixi <i>Endopleura uchi</i> (Huber) Cuatrec. N	Weak	Strong	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Umari <i>Poraqueiba sericea</i> Tul. N	Strong	Strong	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Umbu <i>Spondias tuberosa</i> Arruda N	Strong	Strong	Weak	Weak	Weak	Weak						
	Uva-do-japão <i>Hovenia dulcis</i> Thunb. E	Weak	Weak	Strong	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak
	Uxicuruá <i>Duckesia verrucosa</i> (Ducke) Cuatrec. N	Strong	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak

E Exotic **N** Native **Strong** **Weak**

Figure 1. Seasonality calendar for unconventional or neglected horticultural products (Continued)

HERBACEOUS VEGETABLES		Horticultural crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	E	Abriçó <i>Mammea americana</i> L.	Strong	Strong	Strong	Weak								
	E	Biri-biri <i>Averrhoa bilimbi</i> L.	Strong	Weak	Strong									
	N	Cacauí <i>Theobroma speciosum</i> Willd. ex Spreng.	Weak	Strong	Strong	Strong	Weak	Weak						
	N	Corticeira-serrana <i>Erythrina falcata</i> Benth.	Weak	Weak	Weak	Weak	Weak	Strong	Strong	Strong	Strong	Strong	Strong	Weak
	E	Fruta-pão <i>Artocarpus atilis</i> (Parkinson) Fosberg	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Strong	Strong	Strong
	N	Ipê-amarelo <i>Handroanthus chrysotrichus</i> (Mart. ex DC.) Mattos	Weak	Strong	Strong	Weak	Weak	Weak						
	N	Ipê-branco <i>Tabebuia roseoalba</i> (Ridl.) Sandwith	Weak	Strong	Strong	Strong	Weak	Weak						
	E	Jaca-de-macaco <i>Artocarpus lakoocha</i> Wall. ex Roxb.	Weak	Strong	Strong	Strong	Strong							
	E	Jambo <i>Syzygium malaccense</i> (L.) Merr. & L.M. Perry	Weak	Weak	Weak	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak
	N	Mamorana <i>Pachira insignis</i> (Sw.) Savigny	Weak	Strong	Strong	Weak	Weak							
	N	Mandacaru <i>Cereus hildmannianus</i> K. Schum.	Strong	Strong	Weak									
	N	Maracujá-vermelho <i>Passiflora caerulea</i> L.	Strong	Strong	Weak	Strong	Strong	Strong						
	N	Monguba <i>Pachira aquatica</i> Aubl.	Weak	Strong	Strong	Strong	Weak							

E Exotic **N** Native **Strong** **Weak**

Figure 1. Seasonality calendar for unconventional or neglected horticultural products (Continued)

FRUIT-VEGETABLES	Horticultural crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Aroeira <i>Schinus terebinthifolius</i> Raddi	N	Weak	Weak	Weak	Strong	Strong	Strong	Strong	Weak	Weak	Strong	Strong	Weak
	Pepino-do-mato <i>Ambelania acida</i> Aubl.	N	Weak	Weak	Weak	Weak	Strong	Weak						
	Pupunha <i>Bactris gasipaes</i> Kunth	N	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Strong

SEEDS	Horticultural crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Baru <i>Dipteryx alata</i> Vogel	N	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Strong	Strong	Weak	Weak
	Cumaru-do-amazonas <i>Dipteryx odorata</i> (Aubl.) Willd.	N	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Mamorana <i>Pachira insignis</i> (Sw.) Savigny	N	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Monguba <i>Pachira aquatica</i> Aubl.	N	Weak	Weak	Weak	Strong	Strong	Strong	Weak	Weak	Weak	Weak	Weak	Weak
	Mutamba <i>Guazuma ulmifolia</i> Lam.	N	Weak	Weak	Weak	Strong	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Weak
	Sapucaia <i>Lecythis pisonis</i> Cambess.	N	Weak	Weak	Weak	Weak	Weak	Weak	Weak	Strong	Strong	Weak	Weak	Weak

E Exotic **N** Native **Strong** **Weak**

CONCLUSION

Knowledge of the seasonality of food is of fundamental importance for the planning of menus. During the harvest period, there is a greater offer of horticultural products that also have better prices and sensory quality. The supply centers in Brazilian states, publish their bulletins weekly with the list of all products sold; however, there is a wide range of horticultural crops that are not part of the conventional supply chain, called non-conventional horticultural crops (NCHC). Information on the seasonality of several NCHC, although available in the scientific literature, is dispersed. Thus, it is expected that the proposed seasonality calendar can serve as a tool for planning menus with a greater diversity of neglected or unconventional horticultural crops, and that it can be used by the population and, above all, by food service professionals, aiming at valuing food culture and preserving Brazilian biodiversity. Finally, further development of this study will enable the publication of a tool that includes a greater number of classified NCHC, particularly according to Brazilian biomes.

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Contributors

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