Seeds for a Future
Food Security + Nutrition Solutions

Home Garden Permaculture Systems

Seeds for the Future Agrarian Community

Chocolá, San Pablo Jocopilas

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Summary

For centuries, family gardens have been a haven for a substantial part of the world's agricultural biodiversity, as well as the point at which multiple generations of a family have transmitted knowledge, techniques and practices, along with genetic resources.

The present analysis of home garden systems was carried out in 6 sectors of the community of Chocolá where the gardens are located. We will describe qualitatively and quantitatively the garden systems used in thirteen family gardens.

The family gardens were categorized into the following types:

- Mandala
- Vertical
- Raised bed

Among these thirteen family gardens, six use a mandala system, two use a vertical garden system and five use a raised bed garden system. A great diversity of plants was recorded, including forty-eight species within twenty botanical families. Based on the information obtained at the field level, plant species are classified as follows: nutritious greens, vegetables, condiments, medicinal and basic grains.

The best system implemented in the subject gardens is the mandala system. It provides a higher density of plants per unit area and ease of agronomic management, including irrigation and planting schematics. The mandala system also creates crop associations and interspecific interactions between species, which helps generate microclimates for developing and adapting other crops.

1. Mandala Garden System

1.1 Qualitative Characteristics of the Mandala Garden System

a) The fundamental characteristic of the mandala design is that the crops are planted in raised mounds (camellones), which are laid out in circles around a central circumference.

b) The number of circles or raised mounds will depend on the total diameter of the design, the width of the raised mounds and width of the working space between the circles.

c) The longest raised mounds at the outer edge of the mandala garden are planted with taller crops such as amaranth (bledo), cucumber, nightshade, tomato, chilies (pepper, jalapeño, chocolate, chiltepe, dog's tooth, etc.). Intermediate-length raised mounds are used for crops such as wild rocket, chard, lettuce, and when days are short and cool, some cruciferous species such as cabbage, cauliflower and broccoli. The shorter raised mounds and the central circumference are planted with crops such as beets, onions, and some condiments (celery, coriander, parsley).

d) During the dry season, the soil is prepared, and the mounded rows are built. In the rainy season, it's necessary to use edges or supports to prevent water erosion; these edges can be made of stones, or various containers filled with earth in which some species of vegetables can be grown.

e) In this garden system a gravity irrigation system is used.

The Mandala Gardens Included in This Analysis are Pictured Below:

***Figure 1**. Mandala garden, located in San Felipe Retalhuleu.*

Figure 2. *José Juan Moreno mandala garden, located in the Cinco Calles sector.*

Figure 3. *Mandala garden of Patricia Nohemí Ramírez, located in the Ian Casitas sector*

***Figure 4**. Mandala garden of Nelys Amarilis Joj Castro, located in the Nanzal sector.*

***Figure 5**. Mandala garden of Clara Zapil López, located in Barrio la Unión, San Tomás.*

Figure 6. *Jose Luis Yax mandala garden, located in the Nanzal sector.*

1.2 Quantitative Characteristics of the Mandala Garden System

a) This garden design can be implemented in areas greater than twenty-five square meters.

b) The central circumference should have a diameter of 1 meter. A customary width for the raised mounds is 0.40 meters.

c) The table below includes data for the mandala type gardens that were analyzed: areas for planting crops, total areas occupied and planting distances used in the mandala garden system:

Garden of:	Arable areas (m_2)	Area occupied by the system (m2)	Planting scheme (m)	Planting system
San Felipe, Retalhuleu	11.37	12.57	**Greens:** 0.20*0.20 **Vegetables:** 0.40*0.40 **Condiments:** 0.20*0.20 **Medicinal**: 0.30*0.30	2 offset rows (plants form triangles), or parallel rows of plants with variable spacing
Patricia Nohemí Ramirez	8.82	9.62		
Nelys Amarilis Joj Castro	26.27	28.27		
Jose Juan Moreno	11.37	12.57		
Jose Luis Yax Yax	86.08	88.48		
Clara Zapil Lopez	14.30	15.90		

Table 1. *Quantitative data from mandala-type garden systems analyzed in the community of Chocolá.*

A particular characteristic of the mandala system is the diversification of crops in each raised mound, which produces interspecific interaction between species. This helps to generate microclimates that foster the development and adaptation of other crops, such as the species of the cruciferous family, which grow well in this community when days are cool and short. For implementation of a mandala type garden, it is recommended to have a large area of land with a slope of less than 5%. In this system, no chemicals are used for pest control.

2. Vertical Garden System

2.1 Quantitative and Qualitative Description of the Vertical Garden System

The vertical garden is a system of cultivation of plant species in a substrate supported by a structure that takes advantage of the vertical space. The primary purpose of this garden system is to maximize the horizontal space available for cultivation by projecting the agricultural activity vertically.

The main advantages of the vertical garden system are the efficient use of space and the possibility of growing in small spaces. This system also establishes cultivation near consumption centers, especially in urban areas. A vertical garden leads to more efficient use of agricultural inputs, such as irrigation water and fertilizers, and allows for unique solutions involving space and materials.

a) Among the vertical gardens analyzed, one is made using 3-liter disposable containers filled with substrate and which hang from the rigid wall structure with the help of plastic twine, as shown in the following figure:

Figure 7*. Vertical garden system of Timothy Félix Icó Yac, located in the Ian Casitas sector.*

b) Another vertical garden solution is constructed of bamboo trunks: four long trunks constitute the horizontal portion of the structure. The lowest trunk is planted with chard, the intermediate sections contain lettuce and chard, and in the highest trunk, onions and leeks.

In vertical systems, the planting of crops is planned according to their growing habit, so crops that grow taller will not shade other crops.

***Figure 8**. Demonstration vertical garden, located in the Buena Vista sector.*

2.2 Quantitative Characteristics of the Vertical Garden System

a) A vertical garden system increases the arable space by as much as a factor of ten. For example, if there are 50m^2 of arable space in a raised bed system, this can be transformed into 500 m^2 by implementing a vertical system (Velásquez, 2019). The following table presents data for the two featured vertical garden systems, including arable areas, planting densities and planting distances:

Garden of:	Arable areas (m2)	Area occupied by the system (m2)	Planting scheme	Planting system	Planting density
Timoteo Félix Icó Yac	4.4 m2 vertical	5.6 m2 vertical	**Greens and condiments:** 2 plants/container. **Vegetables**: 1 plant/container	simple	60 plants
Demonstration	4.8 m2 vertical	6 m2 vertical		simple	76 plants

***Table 2.** Data from vertical garden systems analyzed in the community of Chocolá.*

Note that the species of greens and condiments are planted at 2 plants per 3-liter container horizontally oriented. The planting density for vegetables is one plant per container oriented vertically to accommodate their root systems. Planting densities are presented for the specific structures studied.

3. Raised Bed Garden System

3.1 Quantitative and Qualitative Description of the Raised Bed Garden System

The raised bed garden system is the best known and most frequently used for family gardens:

a) The raised bed garden system offers spaces where most species of greens, vegetables, condiments and medicinal plants can be grown. The raised bed system is generally characterized by a rectangular and grid-like shape. The five raised bed gardens analyzed for this report reveal the flexibility that can be employed to meet the requirement of the available space.

b) Three of the raised bed gardens studied are located in areas without slopes and are oriented east-west so that the plants receive the same amount of sunlight, avoiding the effects of phototropism.

The following gardens have a rectangular structure edged with bamboo trunks, as shown in the photos below:

Figure 9. *Raised bed garden of Jose Luis Poroj, located in La Trinidad.*

Figure 10*. Raised bed garden of José Feliciano Joj Zapeta, located in Barrio la Unión*

Figure 11. *Raised bed garden of Vicente Rosales García, located in La Guardianía.*

c) Two of the gardens analyzed are located in areas with slopes greater than 5%; in these gardens, soil conservation is practiced via terraces, as shown below:

Figure 12*. Raised bed garden of Eric Tiguilá Cuc, located in Barrio la Unión.*

Figure 13. *Raised bed garden system of Artemio Xum Xum, located in Mercado sector.*

The raised bed garden system is the most commonly used in home gardens. Weeding is done manually, although some families use organic mulch (coffee leaves, sawdust, woodchips, etc.) to prevent the growth of unwanted plants among the crops. Planting medicinal and crop plants such as onion, leek, marigolds, lemon tea, rue, and other aromatic plants, helps control pests within the garden. It should be noted that in the family gardens of the community of Chocolá no chemicals are used for pest and disease control; most farmers of the area use cultural and ecological practices, including application of organic products for disease control, such as a homemade potassium soap, garlic, horsetail plant, and copper sulfates.

3.2 Quantitative Characteristics of the Raised Bed Garden System

The following table presents the data for the five selected raised bed gardens in Chocolá as to arable area, the total area occupied by the garden, and the planting densities, distances and systems used:

Garden of:	Arable areas (m_2)	Area occupied by the system (m2)	Planting scheme (m)	Planting system
Eric Tiguilá Cuc	15.75	16.15	**Greens:** 0.20*0.20 **Vegetables:** 0.40*0.40 **Condiments:** 0.20*0.20 **Medicinal:** 0.30*0.30 **Basic grains:** 0.40*0.40	Double rows
José Feliciano Joj Zapeta	112.5	113.5		Single rows
Jose Luis Poroj	22.5	22.8		Alternating (tresbolillo)
Artemio Xum Xum	27	27		Double rows
Vicente Rosales Garcia	28	29		Single rows

Table 3*. Data of the systems of garden in raised beds, characterized in the community of Chocolá.*

Planting on raised beds is excellent for diversification and association of crops, making raised beds the best system for the diversity of species produced in a given area. This garden system is functional in any space and facilitates the use of agronomic practices such as pruning, weed control, and plant support with string or twine, etc.

4. Taxa and Botanical Classification of Species Grown in the Family Gardens of Chocolá.

The following table presents the specific species, classified variously as nutritious greens (foliage is consumed), vegetables (tubers, inflorescences, and fruits are consumed), basic grains, condiments (foliage, stems are consumed), and medicinal (tubers, stems, foliage and fruits are consumed).

No.	Classification within the garden	Common name	Family	Scientific name
1	Nutritious Greens (Foliage)	Pigeon foot	Agavaceae	*Iresine diffusa Humb. & Bonpl. ex Willd.*
2		Chard	Amaranthaceae	*Beta vulgaris L.*
3		White Bledo		*Amaranthus albus (L.)*
4		Mozote	Asteraceae	*Bidens Pilosa L.*
5		Wild Rocket	Brassicaceae	*Brassica rapa L.*
6		Arugula		*Eruca sativa mill*
7		Chipilin	Fabaceae	*Crotalaria longirostrata Hook. & Arn.*
8		Watercress	Portulacaceae	*Calandrinia ciliata (Ruiz & Pav.) DC.*
9		Purslane		*Portulaca oleracea L.*
10		Black nightshade	Solanaceae	*Solanum nigrescens M. Martens & Galeotti*
11		Macuy		*Solanum americanum Mill.*
..12		Madre hierba		*Jaltomata procumbens (Cav.) J.L.Gentry*
13		Quixtán		*Solanum wendlandii Hook F.*
14	Vegetables (Tubers, flowers and fruits)	Beetroot	Amaranthaceae	*Beta Vulgaris*
15		Broccoli	Brassicaceae	*Brassica oleracea var. italica,*
16		Cauliflower		*Brassica oleracea var. botrytis L.*
17		Radish		*Raphanus sativus*
18		Cabbage		*Brassica oleracea var. capitata*
19		Lettuce	Compositae	*Lactuca sativa*
20		Cucumber	cucurbitáceae	*Cucumis sativus*
21		Watermelon		*Citrullus lanatus*
22		Ayote		*Cucurbita sp.*
23		Onion	Liliaceae	*Allium strain*
24		Leek		*Allium ampeloprasum var. ampeloprasum var. ampeloprasum pornum*
25		Tomato	Solanaceae	*Solanum Lycopersicum*
26		Chili pepper		*Capsicum annuum L.*
27		Chile Jalapeño		*Capsicum annuum L.*
28		Chile Chiltepe		*Capsicum annuum L.*
29		Potato		*solanum tuberosum*
30	Basic grains	Climbing Bean	Fabaceae	*Phaseolus vulgaris*
31		Bush bean		*Phaseolus vulgaris L.*
32		Corn	Poaceae	*Zea mays L.*
33	Condiments (Foliage and stems)	Cilantro	Apiaceae	*Coriandrum sativum L*
34		Cilantro real		*Eryngium foetidum L.*
35		Celery		*Apium graveolens L.*
36		Parsley		*Petroselinum crispum*
37		White Basil	Lamiaceae	*Ocimum basilicum L.*
38		Purple basil		*Ocimum basilicum L.*
39		Mint		*Mentha spicata L.*
40		Oregano		*Origanum vulgare L.*
41		Rosemary		*Rosmarinus officinalis L.*
42		Apazote	Quenopodiáceas	*Dysphania ambrosioides (L.) Mosyakin & Clemants*

No.	Classification within the garden	Common name	Family	Scientific name
43	Medicinal (Foliage, stems, tubers and fruits)	Marigold	Asteraceae	*Tagetes erecta L*
44		Lemon tea	Poaceae	*Cymbopogon citratus (DC.) Stapf*
45		Rue	Rutaceae	*Graveolens Route L.*
46		Salvia	Verbenaceae	*Lippia alba (Mill.) N.E.Br. ex Britton & P.Wilson*
47		Aloe	Xanthorrhoeaceae	*Aloevera (L.) Burm.f.*
48		Ginger	Zingiberaceae	*Zingiber officinale Roscoe*

Table 4. *Taxonomic classification of the species that are managed in the garden systems.*

In the table, forty-eight species of plants are grown in the categories of nutritious greens, vegetables, condiments, medicinal plants and basic grains. This is an excellent diversity of plants in the gardens. The forty-eight plants belong to twenty botanical families, five of which include the largest number of species. These five plant families are: Solanaceae, Brassicaceae, Amaranthaceae, Lamiaceae, Apiaceae. The remaining fifteen plant families presented include comparatively few species.

The most frequently grown species in the gardens studied are nightshade (hierba mora or mucuy), tomato, bell and jalapeño pepper, chipilín, wild rocket, chard, lettuce, cabbage and onion. Nutritious greens and vegetables can be planted "in association" since their relatively similar heights do not create competition for sunlight. Aromatic plants are used for medicinal consumption and also fulfill the important function of insect repellents without the use of chemicals.

5. Conclusions

- In the communities of Chocolá and Santo Tomas, Suchitepequez, 13 family gardens located in various sectors were studied. Three garden systems were encountered: mandala, vertical and raised beds. Among the gardens analyzed, six are mandala type, two are vertical type, and five gardens are raised bed types. Based on the data obtained for the 13 gardens studied, the best garden system seems to be the mandala system, for its higher density of plants per unit area, ease in agronomic management, crop association, irrigation and applicable planting schemes.

- The garden analysis shows that forty-eight species of plants within twenty botanical families are grown, indicating a considerable diversity of plants produced. Based on the information obtained in the field, these plant species are classified as follows: nutritious greens, vegetables, condiments, medicinal and basic grains.
- In the three garden systems analyzed, success is fostered through the association of crops, which is essential for pest control, and the interspecific interaction of species, helping to generate microclimates for the development and adaptation of other crops such as species of the brassicaseae family (broccoli, cauliflower and cabbage), which can only be produced in the community of Chocolá during short, cool days.
- Thus, families in the community of Chocolá use three garden systems to successfully exploit a variety of available spaces. Through the exchange of seeds and the recovery of almost forgotten varieties, the families and community are advancing along the path of agricultural biodiversity and greater self-reliance.

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