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Article

The Otomi milpa (*ra huähi hñähñu*): agroecological biocultural heritage of the state of Mexico

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Abstract

The industrial agrifood model has impacted on the peasant way of life and the traditional milpa system. For this reason, it was analyzed which elements currently make up the Otomi milpa and which remain in use; likewise, its social, ecological, and cultural perspectives in the field of food were discussed. The research was developed from a historical context, applying ethnographic techniques; two semi-structured interviews were designed and applied to twenty-eight peasant opinion leaders in seven municipalities of the High Valleys region of the state of Mexico. It is indicated that the milpa is a biocultural, sustainable, strategic, and broad construction that is integrated by traditional knowledge and practices, environmental complementarity, communality, and rituality. At present, it is still used and is vigorous and dynamic as a food source for indigenous and peasant families in the High Valleys; in addition, it safeguards the know-how that generates ecological balance and the reproduction of native corn, *ya k'ani* (native vegetables), and forage weeds. In perspective, the milpa is Otomis's own alternative in the face of food, environmental, and health catastrophe; therefore, it can be revalued and strengthened by the new generations without violating its biocultural essence and putting its productive and ecological tradition first.

Keywords:

food sovereignty, polyculture, traditional practices, *ya k'ani.*

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Introduction

The document proposes an analysis of the social, cultural, and ecological elements that make up and remain in use in the Otomi milpa (*ra huähi hñähñu*) and a discussion of its prospects within the food field. The milpa, according to Peña and Hernández (2018), constitutes a heritage asset of biocultural elements that are fundamental to the social, cultural, and identity reproduction of peasants and indigenous people in their territories. It is a community system of relationships of respect, balance, and complementarity between humans, the ecosystem, and rituality; in addition, according to Collin (2021), it is the main provider of local food for milpa-making families.

The milpa integrates traditional agricultural know-how, which is knowledge validated in cumulative experiences (scheme of experiments) as a means to coexist in the environment and guarantee food production. In this sense, over the millennia the *ñätho hñähñu* (Otomi people of the High Valleys) created a way of life complementary to the environment and around agricultural know-how.

Hence, the following is questioned: at present, what social, cultural, and ecological elements make up the Otomi milpa and which are an expression of validity for the agroecosystem by being vigorous within the collective way of life. The hegemonic system defines the milpa and traditional agriculture as a set of ancient and obsolete techniques (Osornio, 2024). A definition that, as Bartra (2018) argues, requires another look from sociology and ecology in order to deepen their understanding and understanding of purpose and seek its revaluation.

It is proposed that if the traditional milpa and agricultural know-how are the subject of contemporary analysis, it is due to the existence of permanent frictions between food production models, between the traditional-sustainable and the hegemonic-industrial. For Osornio (2022), the milpa is an owned, autonomous, diverse, and healthy agrifood alternative that is far from agro-industrial tentacles, which aims at food sovereignty in indigenous and peasant territories.

The research is a sociological work that starts from a theoretical and historical framework that contextualizes the elements of the milpa within a contemporary analysis. The ethnographic method was used, which, in qualitative studies, weighs experiences and meanings of social subjects; for Corona and Maldonado (2018), this paradigm involves an in-depth analysis of the research context and allows us to gather the community's view, in this case, the social, cultural, and ecological elements of the milpa and its perspectives. Two interviews were designed and applied to twenty-eight Otomi peasants in seven municipalities of the state of Mexico; likewise, informal dialogues and on-site tours were conducted.

Agroecological practices and the Otomi people

Agriculture is the result of the symbiosis between humans and the environment. For its part, traditional knowledge about the social, cultural, and productive universe is integrated into the milpa, so traditional agricultural knowledge and practices are the symbolic cultural system of understanding biological elements together with resource management that solves the need for food and coheres indigenous-peasant life (Leyva *et al*., 2020). In this sense, the native peoples took root in and complemented themselves with the environment by amalgamating the biocultural heritage with the enormous amount of genetic resources integrated into the milpa.

Entrenched in a territory, they gave rise to distinctions based on language, worldview, and productive practices; therefore, for González *et al*. (2021), agriculture in each territory is distinguished by the social division of labor, technology, work tools, and individual and community knowledge.

Agroecological practices gather agroecological knowledge based on peasant ecological rationality, recover biocultural heritage, promote social inclusion and food and territorial sovereignty (Vicente *et al*., 2024). In this sense, the milpa system -milli in Nahuatl, refers to the tilled land; the Nahuas did not define the greatness of the agroecosystem because in their original experience in the arid region, they lacked the characteristic elements of the Mesoamerican milpa. For their part, the Otomis in the High Valleys had already built the knowledge and practices of the milpa known today (Wright, 2005)-they do not threaten life, the land, or its resources, nor do they pollute with agrotoxic products; on the contrary, the milpa is ecological and sustainable.

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For Santiago *et al*. (2018), these practices are resilient because they are born from the original worldview, and they even configure a local system that understands geographical, climatic, and biological singularity. For Morales (2018), practices merge knowledge and rituals, uniting humans with the essential natural elements of agriculture: sun, water, and earth, and the cultural elements, deities and soul beings. In the case of Mesoamerican peoples, they were distinguished by having a wide variety and quantity of food from the milpa and the backyard, and in the case of the Nahuas in central Mexico, from the chinampa, systems that rest on a complex characteristic, thought and carved by the Mesoamericans: the agroecosystem of polyculture.

The first to inhabit the High Valleys were the Otomis; however, they are not named among the great Mesoamerican peoples even though they were the first to populate more than half of the territory that today is comprised by Mexico and whose influence on other peoples is undeniable, they are the forgotten ones of history (Wright, 2005). By domesticating breeds of corn, beans, and squash, in addition to forging knowledge and practices, they founded the milpa system with which they managed to establish the first agricultural communities in the High Valleys. Therefore, there is evidence that they benefited from humiferous soils and natural sources of water, such as the Lerma River, lagoons and springs.

Over time, they consolidated their know-how based on understanding the adaptive, reproductive, nutritional, medicinal, and strategic potential of various plant species, but also, like no other people, they managed to understand and inhabit cold, temperate and warm ecosystems (Soustelle, 1993).

Currently, according to the National Institute of Statistics and Geography (INEGI), for its acronym in Spanish, more than one hundred thousand *ñätho hñähñu* live in the High Valleys (INEGI, 2020). Nevertheless, despite all of the above, studies on the Otomi milpa (*ra huähi hñähñu*) in the High Valleys are limited and when adding the biocultural and agroecological categories, we find no precedents. Therefore, the challenge is to analyze and identify its constituent elements and those that make it remain in use.

Materials and methods

The research was carried out in communities of seven municipalities in the High Valleys region, State of Mexico: Pueblo Nuevo, San Antonio Detiñá and San Francisco Shaxní, Acambay; San Lucas Totolmaloya, Aculco; La Comunidad, Jilotepec; San Marcos Tlazalpan, Morelos; Santa Cruz Tepexpan, Jiquipilco; San Antonio Yondejé, Timilpan; San Juan de las Huertas, Zinacantepec (Figure 1). The main productive activity is agriculture in the traditional milpa system; corn, beans, squash, broad beans, peas and oats are grown; there is also a prominent use of weeds as human food and forage for animals.

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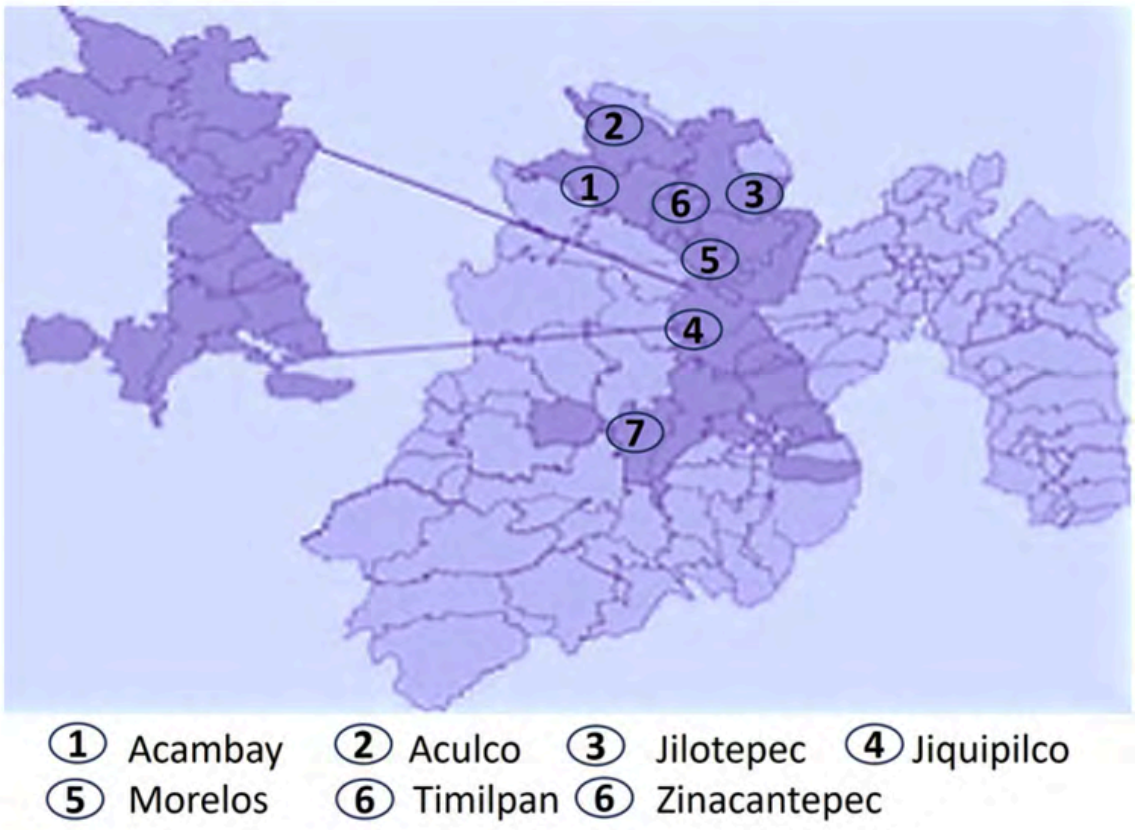
Figure 1. Otomi municipalities of the High Valleys region, state of Mexico.



The soils are clayey, deep and fertile. The predominant climate is temperate with rainfall in summer (Cw), rainfall ranges between 700 and 1 100 mm per year, average annual temperatures oscillate between 16 and 18 °C, and there are strong frosts in autumn and winter. According to the National Institute of Statistics and Geography (INEGI), for its acronym in Spanish, the localities have a population of less than 6 500 inhabitants (INEGI, 2020). Likewise, they preserve deep biocultural elements of the Otomi people: *hñähñu* language, traditional agriculture, systems of positions and governance, communality, customs, traditions, among others, which is why they are cataloged by the National Institute of Indigenous Peoples (INPI), for its acronym in Spanish as indigenous localities (INPI, 2022).

The work presents a sociological approach, so it starts from a historical and theoretical framework; therefore, the documentary review was necessary. In addition, the qualitative ethnographic method was used, which, for Geertz (2017), allows us to understand how people understand themselves and conceive their modes of thought, thus defining the purpose and the meanings they give to their ideas and actions.

Two semi-structured interviews were designed, one was applied to twelve women and the other to sixteen men, which were selected by the simple random sampling method, recognizing their community and productive leadership by participating in the peasant local markets or in the Federation of Corn Producers of the State of Mexico; they are peasants who reproduce the know-how of the traditional milpa, grow native corn, manage crops associated with weeds, and sell their surpluses at the local-regional level. Based on the above, it was possible to identify and analyze the elements that make up the Otomi milpa and that make it remain in use. In this sense, the study was conducted from May 2021 to July 2023.

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Informal talks were held with other Otomi actors: comuneros (members of agrarian communities), ejido authorities, delegates, and responsible consumers, with the purpose of learning about other ideas about the agroecosystem and the uses of weeds; in addition, six on-site tours were conducted on plots with a traditional milpa system.

Results and discussion

In the seven municipalities, more than 50 000 people speak *ñätho hñähñu* (INPI, 2020). In this sense, the biocultural elements in terms of agriculture and the way of life are visible: *ra huähi* (the milpa), pigmented corn of conical and chalqueño breeds, traditional and non-traditional crops (oats and broad beans), *ya k'ani* (*quelites*; tender parts of several plants), collective work through *mfots ´impefi* (family help) that is socially instituted under the mechanism of faena (work) (Osornio, 2024).

Likewise, local knowledge about ecosystems and biological diversity is experiential as they are crowned with rituals in which the Otomis offer flower arrangements, incense, fireworks, food, prayers, and songs to the earth, the sun, and the water. Activities on communal water use, blessing of seeds, and culmination of the agricultural cycle are accompanied by music, dances, traditional foods, fireworks, and decorations. In this sense, by transmitting traditional know-how, biocultural memory is reconstructed by preserving the possibility of existing, surviving and resisting.

It is suggested that the milpa is a biocultural construction since, as it originates in the Otomi imagination, it is concretized in its reproduction based on the understanding of the elements of the environment; for Bartra (2018), it is an age-old, sustainable, strategic, broad-based agri-food system, which is why it represents the food pillar of peasant and indigenous families in rural areas. We will add that it is a community-based, dynamic and resilient production system because, as it is managed from the ecological diversity of the agroecosystem, it remains instituted as the heritage of the Otomi people by granting the possibility of territorial anchorage, food sovereignty, and ecological and energy balance.

In the *ñätho hñähñu*, the knowledge and agricultural practice of the milpa are elements that are reconstructed from their collective consciousness, which allows them to transmit the know-how to their new generations, to reproduce native species, to revalue polycultures, to prepare and apply clean fertilizers (manure, ashes, composts, biol, biosols) that do not pollute the ecosystem, plan production based on a calendar associated with religiosity and ceremonies of petition for a good rainy season.

That is, the end of droughts, the early arrival of rains, the absence of early hail and frosts, the sustainable use of water for irrigation (in some cases, spring water is used and rationalized communally); to continue the mass selection of the most vigorous native seeds according to qualities of color, health, shape, and consistency (mainly corn, beans, and squash), bless them on February 2 at a community mass and exchange them communally among relatives, neighbors, and acquaintances, reduce mechanization in order not to compact the soils, reduce production costs, use the team and traditional tools such as the wooden shovel to sow, the sickle, and the hoe.

For millennia, the Otomis understood the types of soils, the rainfall cycles and the seasons of drought, wind and frost since it was essential to obtain productions in the rainfed system, which is subject to the behavior of rainfall and the capacity of the soils to retain moisture. Likewise, the environmental, sociocultural, and technological elements are dynamic so the milpa was adapted to them. For Linares and Bye (2015), this dynamism is generated by constant exchanges of know-how and genetic diversity, in this case, with Mazahua, Matlazinca, and Ocuilteca knowledge.

Among the elements of the milpa that are currently used, the quality of producing food (grains, vegetables, roots, and flowers) in spaces with knowledge, tools, labor force and inputs typical of the Otomis stands out. *Ya k'ani* are the native uncultivated vegetables of the milpa that coexist harmoniously with the main crops and are consumed in the seven municipalities analyzed. According to Osornio (2024), kalint'o, k'ankho, xith'o, xik'uni, nabushi, and n'vidia are the most valued and are also traded in local regional markets. There is such a current demand for some ya k'ani species that it was identified that they are currently produced in sophisticated greenhouses

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in the municipalities of Acambay, Jilotepec, Jiquipilco, and Aculco; these changes indicate the emergence of a new process of production of native vegetables outside the principles of the milpa agroecosystem. The first are harvested in February and the latter in November, tolerating low temperatures and droughts; however, the hard frosts of autumn-winter stop their production.

The seasonality of milpa production is possible, according to Balcázar *et al*. (2020), due to the structure of the soils and their moisture retention capacity. For Magdaleno *et al*. (2016), the High Valleys are one of the important and last reservoirs of native corn: black, blue, pink, red, and yellow, early breeds that are grown in association with beans, broad beans, squash, peas, and chilacayotes.

In this sense, it was identified that the Otomis continue to gather food, medicines, fodder, and fuel in their common areas: forests, hills, besanas, plains, and runoff. On the other hand, in the plots where they make the milpa is where fourteen species of native vegetables coexist harmoniously, which are considered by Linares and Bye (2015) as undervalued and underutilized species of traditional use; among them are *Amaranthus* spp., *Chenopodium* spp., *Solanum* spp., *Medicago* spp., *Portulaca* spp., *Malva* spp., and *Rumex* spp.

In contrast, according to González and Fernández (2020), these native vegetables are the meaning of the milpa by expressing high value as food elements of profound significance, only after corn and beans. By culture and tradition, corn is the main crop in the milpa; nonetheless, in Acambay and Aculco, in some cases, beans or squash were identified as the main one; the peasants manifest that this is due to the importance of producing green beans, flowers, and tender squash for sale.

Likewise, the endemism of corn breeds also transcends: Cacahuacintle, of great gastronomic and symbolic value in the Otomi municipality of Jiquipilco and the Mazahua region of Ixtlahuaca (Cárdenas *et al*., 2019); the bittersweet Rosado, resistant to droughts in the Acambay Valley; the Tolonki corn, adapted to altitudes of more than 3 600 masl in the foothills of the Nevado de Toluca and in the municipalities of Zinacantepec, Morelos, and Timilpan (Gámez *et al*., 2014).

The milpa provides food sovereignty, nutrition, and health for the Otomis; Soustelle (1993) assures that the *hñähñu* of the twentieth century were less ill and their physical vigor and longevity was greater than that of the Nahuas or Toltecs. In addition, the milpa expresses the inseparable union between the agroecosystem and human life; for Doroteo (personal communication, 2022), an Otomi peasant woman from La Comunidad, municipality of Jilotepec, Mexico -the milpa is like a mother who feeds the family, so a man will not be able to cultivate the milpa and corn without the woman and a woman will not be able to grow the milpa without the man, this is also the case in the harvest, the woman and the man, as a union of life, together must reap the fruits of the milpa-.

The Otomis define *ra huähi* as the space that resulted from centuries of their productive, social, and cultural activity; thus, it is valued as the most important in the food trilogy of the native peoples: milpa-forest-backyard (González and Fernández, 2020). This suggests that they managed to consolidate the milpa with main crops, invigorated it with native vegetables previously collected in the forest, and expanded it with weeds used as forage, medicine and ornament.

Likewise, the besana is an element unified with the milpa, it is the dividing space between plots in which there is an infinite number of resources: *ya k'ani*, magueys, and nopales; medicinal plants, grasses, fruit and woody trees (mainly peaches, Mexican hawthorn, and wild cherries), which, in addition to providing fruits, provide shade that harmonizes the rest of the peasants; by pruning these plants, their competition is balanced and fuels and inputs are obtained to produce organic fertilizer. Overall, the besana offers buffering to the main crops against potential damage from very strong winds and pest invasions.

It was determined that there is a certain energy balance in the milpa, which originates from the use of technologies from novel biodigesters, manual tools, and traditional manual practices, such as sowing, hoeing, weed cutting, and harvesting, which, according to González *et al*. (2021), do not alter entropy and maintain a permanent trend of natural reorganization in the ecosystem.

In addition, peasant know-how indicates that the use of agrotoxic products generates contaminated food and a shortage of *ya k'ani* and forage; in the rolling hills, hills, plateaus, ravines, and gullies, their use is extremely low, but it is high in the plains; in any case, their application eradicates the

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integrity of the ecosystem, with glyphosate and paraquat being the greatest enemies of diversity. For Alonso (personal communication, 2022), an Otomi peasant woman from San Marcos, municipality of Morelos, Mexico, -the milpas that receive herbicides are left without *ya k'ani*, the plants that the *Xitas* (grandparents) taught us to gather in the milpa and that are very nutritious and tasty; here we continue to eat them all the time and when there are no more we have to buy them-.

The Otomis continue to fertilize with manure and ashes, and in low proportion, with conventional fertilizers, usually nitrogenous, such as the commercially called urea. In localities of Acambay, Aculco, and Jilotepec, with previous training processes and through biodigesters, they produce biols and biosols that have been integrated into the know-how.

Likewise, the milpa shows its validity by generating nutritious, healthy, and succulent products (Leyva *et al*., 2020). According to Maurilia (Personal communication, 2022), an Otomi peasant woman from Endéje, municipality of Acambay, Mexico, -the products of the milpa are clean and eating quelites gives us health, by growing them in the milpa, in addition to eating them, we can sell them in the Tianguis Campesino- a collective space self-managed by peasants to exhibit and exchange their agricultural, artisanal and gastronomic products. It is located in the central square of the municipality of Acambay, Mexico. For Hernández (Personal communication, 2023), an Otomi peasant man from San Marcos, municipality of Morelos, Mexico, -the black and pink corn that we harvest in the milpa is clean because it has no chemicals (agrotoxic products) and is very tasty; the beans are of better quality than those sold in the store and we like to eat them as green beans-.

At present, peasants generally sell the surpluses of the milpa to the final consumer without intermediaries. They rely on (Otomis) peasant *tianguis* (open-air markets) created in the municipal capitals of Acambay, Temoaya, Jiquipilco, and Timilpan; these processes have new social actors, allies of the peasants, in the role of responsible consumers: free actors (with decisions outside the hegemonic system), professionals, graduates, among others. Other examples were identified: a) every day the Otomis from San Lucas Totolmaloya, Aculco, go out to market their seasonal surpluses (mainly *ya k'ani*, ears of corn, squash flowers, chilacayotes, and tender squashes) to San Juan del Río, Querétaro and b) the Otomis from Santa Cruz Tepexpan, Jiquipilco, go out weekly to sell their surpluses (*ya k'ani,* tender broad beans, nopales, and squash flowers) to Toluca, state of Mexico.

The species of the milpa were adapted to several types of terrain, so they are found in plains, rolling hills, hills, plateaus, ravines, and gullies; consequently, the crops adapted to droughts and low water amounts. For the Otomis, as Osornio (Personal communication, 2023), an Otomi peasant man from San Antonio Detiñá, municipality of Acambay, Mexico, assures us -the production results in the milpa are good, a single crop of corn or beans (individually) under rainfed conditions has a production of 2 to 3 t ha^{-1}, as a polyculture the yields do not change, but one must add the production of the other crops, the *k'ani*, and especially the forage weeds that we use for our animals-.

The analysis suggests that the prospects of the milpa, in the tensions in the field of food, are encouraging as opposition to the hegemonic system. It indicates that the biocultural anchorage, that is, Otomi agroecological knowledge and practices have resisted. In this way, it is currently used as a food, agroecological, and resilient option based on eleven actions carried out by the Otomis: transmission of traditional agricultural know-how, reproduction of milpa practices, use of traditional technology, valuation of all the species of the milpa and communal exchange of native seeds, generation of clean fertilizers, opposition to the use of agrotoxic products, strategic use of family labor in the form of mutual aid with neighbors, relatives, or community members, construction of their own marketing strategies and for the advances in the formalization of an alliance with responsible consumers that began with the peasant markets with links with universities and civil organizations.

The milpa advances towards food sovereignty, resisting as an alternative to industrial agriculture, based on five conclusions: i) traditional agricultural know-how is agroecological science that can be revalued, transmitted, and cultivated; ii) the Otomis of Valles Altos are decisive actors as they possess biocultural heritage and preserve the greatest biodiversity and natural resources; iii) the reproduction of the milpa is a current and validated action that is ecologically pertinent and efficiently productive; iv) the demand for peasant products, generally valued as nutritious,

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ethical, and sustainable, is growing; and and v) the informal alliance (which may be formal) between peasants and responsible consumers is advancing with the opening of new spaces for exchange and the new actors act by choosing the difference and they strive for alternative products to industrial ones.

The milpa configures and communicates codes of knowledge and practices that are in opposition to the hegemonic system. Meanwhile, it is expected that: a) the tension between the ecological-traditional and the industrial-conventional will be maintained, pointing out that the milpa can be strengthened from its historical practice in limiting conditions since, by facing the adverse effects of climate change, the agroecosystem has greater options for resistance; b) there will be greater peasant resistance and the possibility is opened for new generations to continue to revalue ecological rationality, territorial environmental understanding, the properties and requirements of traditional crops, and biological complementarity, which are elements of traditional agricultural know-how; c) there will be an increase in the participation of responsible consumers, social actors who have taken sides with the traditional peasant and direct production from demand and d) there will be an emergence of new exchange practices, actors voting freely with their wallets (as a conscious purchase) in direct rejection of the agro-industrial system.

The document is a contemporary reading of the thought of the Otomis of the High Valleys; it indicates a posture opposed to industrial agriculture and food, to the use of agrotoxic products, and technological packages, and above all, to the contempt for the peasant way of life. In this sense, it communicates the milpa system and exposes the existence of valid elements in the agrosystem, so it contributes to revaluing traditional agricultural knowledge and practices.

The results allow us to refute the proposals originated by the Green Revolution, which, according to Mirafuentes and Salazar (2022), considered homogenizing agriculture into monocultures based on technological packages, mechanization, unlimited use of natural resources and fossil energies, in addition to devaluing traditional agroecosystems. In contrast, for the Otomis, the milpa is an alternative, valid, dynamic and communitarian agrifood system, the axis of rural food sovereignty in which grasses, legumes, native vegetables, and fruit trees are grown; on the other hand, as a whole, it represents identity, resistance, and defense of biocultural heritage.

While local knowledge helps peasant communities in their food sovereignty, currently, it also opens up the possibility of resistance and adaptation to new environmental and health problems. The *ñätho hñähñu* were the first to inhabit the current state of Mexico; Wright (2005) assures that, before the 12th century BC., there were already significant Otomi agricultural communities established in the valleys of Jilotepec, Acambay, and Toluca. This indicates that, two and a half millennia before the Toltec splendor, this people domesticated and cultivated a large number of breeds of corn, beans, and squash in regions with altitudes greater than 2 500 m, with temperate, cold, and warm climates.

Conclusions

Traditional agriculture has resisted, overcoming the obstacles of the industrial agrifood system and the existing tensions in the global field of food, hence, the Otomi milpa, being made up of traditional knowledge, practices, and technologies, native species, biological diversity and ecological complementarity, communality, mutual aid and rituality, remains in use, vigorous and solid in the municipalities of the High Valleys of the state of Mexico.

In addition, the milpa protects the reproduction of the largest number of breeds of native pigmented corn, beans and squash and fourteen species of *ya k'ani* that are strongly valued, consumed and demanded in local regional markets. It is no exaggeration to suggest that the milpa is the biocultural center of the Otomis and the most important traditional agroecological entity that generates food and forage.

At present, the *ñätho hñähñu* are still in their ancestral territories, preserve the biocultural heritage, reproduce the milpa and the traditional food worldview and cultivate and transmit sustainable agricultural knowledge, practices and technologies. This indicates that the milpa continues to be the most important broad source of local food for indigenous, peasant, and rural families in the state

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of Mexico, so in perspective, it means the Otomis' own alternative to the food, environmental and health catastrophe. So, as a whole, it can be revalued and enhanced without violating its biocultural essence, putting its productive and ecological tradition and its social and economic importance first.

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