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Research Article

A database design to find new organic produce using latitudes and soil orders

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Organic agriculture has had a long history especially after the establishment of International Federation of Organic Agriculture Movement (IFOAM, 1972). However, the organic land share is still 1.5% in the world. This article proposes a database design to find new organic produce according to latitudes and soil orders. As a result, we have completed the practical database which could be used by any organic producers around the world to find new produce in their farms.

Key words: New organic produce discovery database design, organic 3.0, organic farming promotion

INTRODUCTION

IFOAM has led the global organic agriculture by defining organic 1.0, 2.0 and 3.0 up to this time. We are now at the era of organic 3.0 (Markus Arbenz, et al. 2016). One important challenge in Organic 3.0 is to accelerate the conversion from conventional to agriculture agriculture. It is extremely important for farmers to find new, profitable and attractive produce (crops, fruits, herbs) in each organic farming sector globally. In this paper we study the relationship between latitudes, soil orders and produce by reviewing papers and retrieving the Internet to establish the database.

MATERIALS AND METHODS

We have created a simplified proposed OSI reference model of organic agriculture (Figure 1) (Folts, 1993). Layers 1 and 2 protocols are uncontrollable by mankind which can be referred to as basic protocol sets (latitudes, soil orders). Layers 3, 4, 5, 6 protocols are controllable by farmers which can be said as yield protocol sets (field, irrigation, fertilizer, prevention) relevant to increasing produce yields.

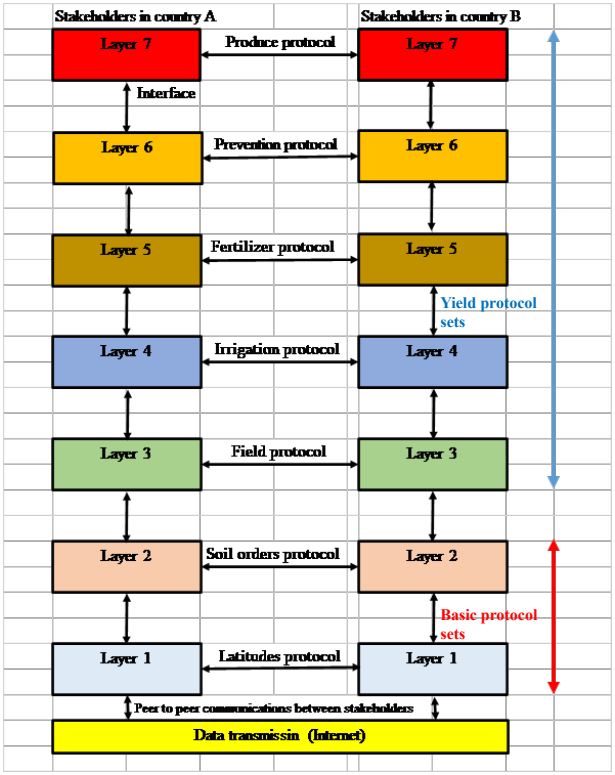

Figure 1. A simplified proposed OSI Reference Model of Organic Agriculture (Modiied from Folts 1993).

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The layer 1 latitude protocol determines the temperature and the precipitation (Figure 2) (Roper, 2016). Mean surface air temperature versus latitude shows the same symmetric trends about the equator. Mean precipitation versus latitude is almost symmetric about the equator. Therefore, the produce is supposed to be symmetric in farms in the same north/south latitudes and in the same soil orders.

Layer 2 protocol is composed by soil orders (Smith, 1999). Soil orders selected in this paper are entisols, aridisols, inceptisols and alfisols because they occupy 55 % of the global ice-free area (Table 1).

Layers 3, 4, 5, 6 are out of scope in this paper because there are no specific data available at present and further academic research and development and innovation are also required to increase crop yields thanks to these protocols. Layer 7 protocol is produce (crops, fruits, herbs). Based on these protocols, basic philosophy to design a database is summarized as below.

• The database is composed of latitude (Layer 1), soil orders (Layer 2) and produce (Layer 7) protocols,

• Soil orders: Entisols, Inceptisols, Aridisols, Alfisols (cover 55% of the earth's ice-free land area),

• Produce in farms: Searched on the same latitude and in the same soil orders by the Internet.

Therefore, we have chosen these three protocols to measure the produce grown on farms around the world because we can get these protocols with ease. The database can be used to identify produce which is suitable to farmers' locations (relevant to temperature and precipitation) and soil orders. The latitudes selected for the database design are from equator to 20th parallel north/south, 40th parallel north/south and 60th parallel north/south allowing for an error of plus/minus five degrees.

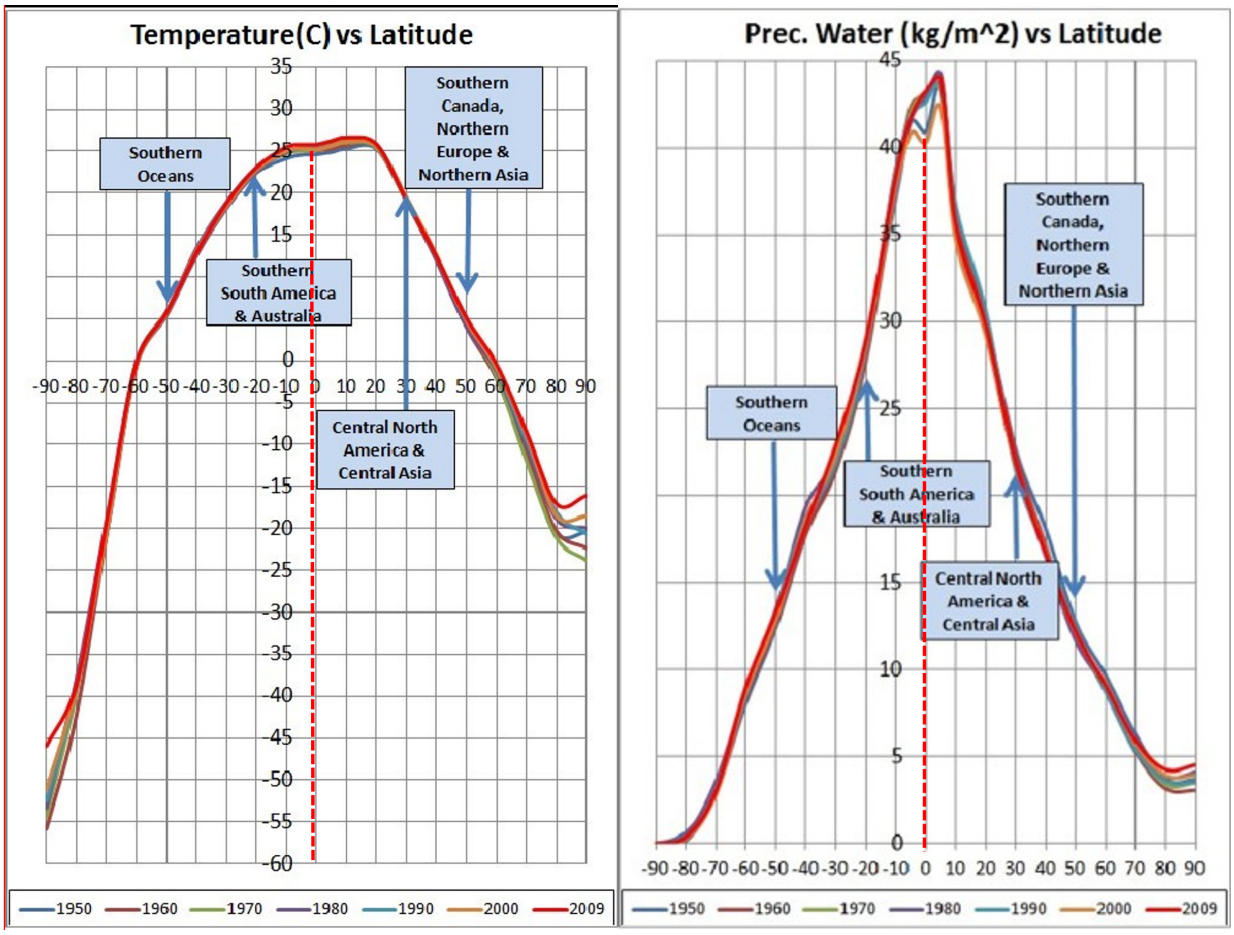

Figure 2. Layer 1 protocol: Latitude (Once the latitude is given the temperature and precipitation are determined (Roper 2016).

Table 1. Layer 2 protocol: Soil orders.

Soil orders	Soil characteristics
Entisols (18%)	Entisols of large river valleys and associated shore deposits provide cropland and habitat for millions of people worldwide.
Aridisols (12%)	They are used mainly for range, wildlife and recreation. Because of the dry climate in which they are found, they are not used for agricultural production unless irrigation water available.
Inceptisols (15%)	A sizable percentage of Inceptisols are found in mountainous areas and are used for forestry, recreation and watershed.
Alfisols (10%)	Alfisols to be very productive soils for both agricultural and silvicultural use.

RESULTS

The database composed of crops, fruits and herbs of organic farms ranging from 60th parallel north to 60th parallel south has been made (Table 2). Representative cities or towns relevant to the latitudes and soil orders have also been listed in the left column of the database. But most appropriate these ranges are from 40th parallel north to 40th parallel south because at the 60th parallel north, farmers can't produce anything without using artificial energy (mainly electricity) and at 60th parallel south only the sea is observed. We must promote organic farming which is environmentally friendly.

Table 2. Database showing relations between latitudes, soil orders and produce.
Note: (■) Entisols(18%), (■) Aridisols(12%), (■) Inceptosols(15%), (■) Alfisols(10%)

60th parallel north	Entisols(18%)	Aridisols(12%)	Inceptosols(15%)	Alfisols(10%)
Representative cities on Entisols: None Representative cities on Aridisols: White horse, Canada Representative cties on Inceptisols: Rey Kjavik, Iceland, Helsinki, Finland Representative cities on Alfisols Tallinn, Estonia	None (no countries)	Carrots, beets, tomatoes, cucumbers, zucchinis, onions, peas, beans, radishes, herbs, garlic. (They use greenhouses, caterpillar tunnels).	Apples, beets, broccoli, cauliflower, cabbage, carrots, celery, cucumber, garlic, kale, leeks, lettuce, potatoes, rutabaga,sweet pepper, rainbow chard, rhubarb, tomato, turnip, zucchini, arugula, artichoke, basil, brussels, collard, dill, drumstick bean, escarole, ginger, kohlrabi, lemon, onion, parsley, peas, peppers, radicchio, scallion, spinach, sprouts, squash, strawberries. (No greenhouse crops in Finland. In Iceland they use greenhouses powered by geothermal energy).	Apple, broccoli, carrot, cauliflower, cucumber, eggplant, garlic, grape, leek, lettuce, potato, sweet pepper, tomato.
40th parallel north	**Entisols (18%)**	**Aridisols (12%)**	**Inceptisols(15%)**	**Alfisols(10%)**
Representative cities on Entisols Istanbul, Madrid, Athens, Denver Representative cities on Aridisols: Sacrament, CA Baku, Azelbaijan Representative cities on Inceptisols: Tian an, China Tirana, Albania Representative cities on Alfisols: Elburn, Chicago Athens Lisbon Tallinn, Estonia	Artichokes, asparagus, banana, broad beans, celery, chard, corn, cucumbers, eggplant, figs, garlic, grapes, okra, onion, peas, pears, peanuts, pepper, pineapple, potatoes, pumpkins, radish, tomato, turnips,watermelon, zucchini, apple, arugula, avocado, beans, beets, broccoli, cabbage, cauliflower, carrots, cherries, chestnuts, endive, fennel, ginger, grapefruits, lemon, leek, lettuce, lombard pea, loquats, mangoes, melons, shiitake, oranges, pak choi, peaches, parsley, pistachios, pomegranates, purslane, quince, red chili, romaine hearts, sweet pepper, swiss chard, sorrel, spinach, strawberry, turmeric, vine leaves.	Apples, apricots, banana, blackberry, carrots, cabbage, cauliflower, cherries, corn, cucumber, garlic, grapes, greens, green beans, mango, oranges, onions, peaches, pears, pineapple, plums, potato, pumpkin, sweet pepper, strawberry, tomatoes, watermelon, zucchinis, arugula, beets, black current, broccoli, brussels sprouts, cantaloupes, celery, chinese turnips, collards, eggplant, figs, grapefruits, hot peppers, kale, kiwi, kohlrabi, long beans, limes, lemons, lettuce, micro greens, mustard greens, mandarins, nectarines, okra, peas, pomegranate, prune, radishes, swiss chard, salad, salad mix, sour quince fruit, raspberry, rose petals, sweet potatoes.	artichoke, aubergine, beans, broccoli, cabbage, carrot, cauliflower, corn, eggplant, garlic, kale, lemon, leek, lettuce, mango, onion, orange, pepper, potatoes, squash, tomato, watermelon, zucchini, alfalfa, apples, avocado, banana, bulb mask, brussels sprouts, chestnut, celeriac, chard, chicory, cucumber, escarole, fennel, figs, grapes, four legged beans, hemp, melon, mushroom, okra, peas, peach, pineapple, purple chrysanthemum, Romaine lettuce, spinach, sweet potato, turnip, white iron stick yam,	Apple, artichokes, arugula, sparagus, banana. basil, beets, broccoli, cabbage, carrots, cauliflower, celery, chard, cilantro, cucumber, garlic, lettuces, lombard pea, onions, parsley, peas, peppers, potato, pumpkin, radishes, spinach, strawberries, sugar snap peas, tomatoes, turnips, zucchinis, amaranth, bables, beans,beldroegas, brussels sprout, celeriac, cherry, chicory, collard greens, dill, eggplant, fava, fennel, grelos, horseradish, kale, leeks,loon,melons, mixedgreens,parsnips, peppermint, pinion, radicchio, rosemary,rutabag, summer squash, shallots, thyme, tomatillos.

20th parallel north	Entisols (18%)	Aridisols (12%)	Inceptisols(15%)	Alfisols(10%)
Representative cities on Entisols Mexico city Hanoi Representative cities on Aridisols Merida, Mexico Jamnagar, India Representative cities on Inceptisols: Bhubaneswar, India Merida, Mexico Representative cities on Alfisols: Bayamo, Cuba Mumbai, India	Apple, bananas, beans, beetroot, bitter gourd, broccoli, cabbage, carrot, cauliflower, chili, cucumbers, eggplant, garlic, grapes, green peas, lettuce, lime, mangoes, mushroom, orange, peaches, pineapples, potatoes, strawberry, onion, sweet pepper, tomato, zucchini, alfalfa, almonds, asparagus, avocado brussels sprouts, chayote, coriander, chinese cabbage, coconuts, dates, dragon fruits, drumstick, guava, ginger, kale, kiwi, kohlrabi, lemon, okra, parsley, papaya, pears, plums, prune, pumpkin, pomegranate, radish, red beet, red pepper, rosemary, roquette, reddish, spring onion, starfruits, spinach, taro, turnip, thyme, tomatillo, white radish, yams.	Apple, bean, chili, cucumber, drumsticks, garlic, ginger, kaffir leaves, lettuce, mangos, onion, potato, sweet potato, tomato, arugula, asparagus, avocado, banana, basil, beetroot, bitter gourd, broccoli, carrot, cabbage, cauliflower, cebollina, celery, coconut, corn, eggplant, epazote, galangal, grape, green, kiwi, lemon, lemon grass, longan, mangosteen, melons, mushroom,papaya, passion fruit, pineapple, pea,pomelo, rambutan, radish, soybean, squashes, turmeric, watermelon, wollongong, zalacca.	Avocado, banana, cabbage, bean, carrots, chili, cucumber, gourd, mango. onion, potato, pumpkin, safflower, sweet potato, tomato, arugula, basil, barley, beetroot, bell pepper, bitter gourd, cebollina, chat, chickpea,corriander, citrus, coconut, coffee, corn, dragon fruit, drumstick, eggplant, enset, epazote, finger millet, french bean, field pea, fenugreek, garlic, ginger, grass pea, green peas, groundnut, guava,habanero, haricot hot peppers, herbs, horse bean, jack fruit, kale, leek, lentil, lettuce, lime, melons, mint, mushroom, oats, okra, papaya, pomelo, pulses, radishes, snow peas, sorghum, sour oranges, spinach, strawberry, sugar cane, taro, tea, tef, watermelon, wax, wheat, yams, xcatic, zucchini.	Arugula, broccoli, cabbage, carrots, cauliflower, chili, coriander, cucumber, drumstick, garlic, ginger, lemon, lettuces, mango, mushroom, radish, onion, pea, potato, pumpkin, radish, squash, sweet pepper, tomato, avocado, bamboo, banana, basil, bottle bean, beetroot, bitter gourd, cebollina, chives, celery, melons, epazote, gourd, green, green peas, kiwi, okra, parsley, papaya, snow pea, sour oranges, spring onions, strawberry, watermelon, zucchini.

0 equator	Entisols (18%)	Aridisols (12%)	Inceptisols(15%)	Alfisols(10%)
Representative cities on Entisols Mogadishu, Somalia Belen, Brazil Representative cities on Aridisols Nairobi, Kenya Quito, Ecuador Representative cities on Inceptisols Nairobi, Kenya Manaus, Brazil Representative cities on Alfisols: Nairobi Kampara, Uganda	Banana, basil, carrots, chili, dates, lettuce, mango, asparagus, bitter melon, black pepper, broccoli, cabbage, cacao, chinese celery, chinese kale, chinese radish, choy sum, coffee, coriander, corn, cucumber, eggplants, ginger, lemon, mint, mushrooms, okra, onion, orange, pineapples, pumpkin, paw paw, spinach, spring onion, tomatoes, vanilla, watermelon, yard-long bean.	Cabbage, capsicum, babaco, blackberries, broccoli, carrots, jute mallow, lemons, merenda, onion,passion fruit, spices, spinach, sweet potato, swiss chard, tomatoes, zucchini.	Avocado, bananas, cabbage, capsicum, carrots, chili, courgette, kales, onions, potato, pumpkin, spinach, sweet passion,sweet peppers, tomatoes, apple, aramanth, bean leaves, beetroot, black night shade, broccoli, cassava, cauliflower, celery, chia, coffee, coriander, cucumber,drumstick, french beans, jute mallow, leeks, lemon, lime, macadamia, mangos, merenda, mint, moringa, mushroom, pepino melon, rambutan, red pepper, rosemary, terere, tsaga, watermelon.	Bananas, broccoli, carrots, cauliflower, chili, coriander, cucumber, leek, onion, potato, pumpkin, tomatoes, avocado, beetroot, bean leaves, black night shade, cassava, cabbage, capsicum, celery, chia, coffee, coconuts, courgette, corn, eggplant, french beans, garlic, kales, lettuce, mint, mangos, macadamia, moringa, mushrooms, papaya, passion, passion fruits, pepino melon, pineapple, sweet potato, spring onions, spinach, spring saga, swiss chard, rosemary, terere.

20th parallel south	Entisols (18%)	Aridisols (12%)	Inceptisols(15%)	Alfisols(10%)
Representative cities on Entisols Potosi, Bolivia Antsirabe, Madagascar Representative cities on Aridisols Mount Isa, Australia Salta, Argentina Representative cities on Inceptisols Windhoek, Namibia Asuncion, Paraguay Representative cities on Alfisols: Beila, Mozambique Espirito Santo, Brazil	Apples, avocado, beet root, broccoli, butter nuts, cabbage, carrot, cauliflower, celery, chili, cowpea, cucumber, eggplant, garlic, kale, lettuce, mangoes, onion, potato, pumpkin, turnip, tomato, watermelon, sweet pepper, zucchini, artichokes, banana, bitter gourd, blueberry, bok choi, chinesecabbage, chinese veg choi, coriander, corn, dill, fennel, ginger, grape, leeks,melon, mushroom, mint, pak choy, parsley, peanuts, pineapple, radish, rambutan, rice plant, rosemary, shallots, silver beet, snow pea, sweet turmeric.	Apple, banana, beans, broccoli, cabbage, corn, garlic, mango, lemon, onion, pear, potato, pumpkin, radish, strawberry, sweet potato, tomato, zucchini, bitter gourd, carrots, cassava, cauliflower, cashew, celery, chili, cocoyam, cucumber, dil, eggplant, fennel, grape, groundnuts,kale, lentils, mahangu, marrows, mustard, paw paw, peanuts, pineapple, publica, radish, rice, spinach, sweet pepper, turnip, watermelon, wheat.	Avocado, beans, beetroot, broccoli, cabbage, carrots, celery, chili, corn, cucumbers, garlic, ginger, leeks, lemon, lettuce, lime, mushroom, onions, potato, pumpkin, radish, spinach, sweet potato, sweet peppers, tomato, watermelon, alfalfa, apple, apricot, banana, beet, bok choy, blueberry, brinjal, bulb, cauliflower, cherries, chives, coriander, dark opal basil, eggplant, fennel, kale, kiwi, grape, green beans, guava, lemon basil, mango, melon, microgreen, mint, nectarine, pak choy, oranges, parsley, pears, pepper, pineapples, pomegranate, rosemary, sage, silver snow peas, rhubarb, spring onion, sprout, sweet basil, thyme, turnip, turmeric, zucchini.	Banana, carrot, cabbage, chili, cucumber, coffee, lettuce, maize, mango, orange, onions, pineapple, potato, pumpkin, rice, tomato, turnip, watermelon, alfalfa, apple, avocado, beans, beetroot, bitter gourd, cassava, coconuts, grapefruits, grape, guava, lime, litchis, macadamia nuts, papaya, spring onion, soya, sorgum, soybean, sugarcane, strawberry, taro, zucchini.
40th parallel south	**Entisols (18%)**	**Aridisols (12%)**	**Inceptisols(15%)**	**Alfisols(10%)**
Representative cities on Entisols Wellington, NZ Santa Rosa, Argentina Representative cities on Aridisols Buenos Aires Argentina Representative cities on Inceptisols Wellington, NZ Valdivia, Chile Representative cities on Alfisols: Tasmania, Australia Christchurch, NZ	Apples, celery, lettuce, onions, tomatoes, alfalfa sprouts, avocado, bananas, blue berries, cabbage, capsicum, carrots, cauliflower, chard, cucumber, garlic, grapes, kale, kiwi, leeks, lemon, mandarin orange, pak choi, pears, plums, potatoes, pumpkin, red beetroot, spinach, spring onion, telegraph cucumber, zucchini.	Apples, beans, garlic, grapes, lemons, maize, onions, oranges, pears, seed, sugar cane, Sunflower, wheat.	Artichoke, broccoli, brussels sprouts, cabbage, carrot, cauliflower, coriander, cucumber, lettuce, pea, pumpkin, spring onion, squash, tomato, apple, almond, bean dwarf, basil, beets, bean, berries, beetroot, bean broad, borage, blueberry, buckwheat, burnet salad, capsicum, catnip, celery, chervil plain, chamomile, climbing mesclun mix, corn, german chive, dill, fava beans, feverfew, figs, fennel, grape, hummus, kale, leek, lemon balm, macadamia nuts, marjoram sweet, mizuna, mustard leaf onion, oregano, parsley, parsnip, peach, pita, pistachio, potato, radish, red beet, rhubarb, rocket, rock melon, rosemary bush, sage, silver beet, snap peas, spinach, strawberry, sweet potatoes, tansy tarragon, thyme, turnip, tzatzikihili, walnuts. Watercress, watermelon, zucchini.	Apples, avocados, beetroot, blueberries, broccoli, cabbage, capsicum carrots, cauliflower, celery, corn, courgettes, cucumbers, garlic, eggplant, grapes, kiwi, kale, leek, lemons, lettuce, mandarins, onion, orange, parsnips, peaches, potato, pumpkin, snow pea, strawberry, spinach, spring silver beet, potatoes, tomato, almond, artichoke, asparagus, bananas, beans, berries, broccolini, brussel sprouts, buttercup, cavalo nero, fava beans, figs, grapefruit, gold tamarillos, green bean, hummus, kumara, limes, macadamia nuts, melons, mushroom, peas, persimmons, plums, pak choi, parsley, pears, pistachio, pita, radishes, red beet, sugar snap peas, spring onion, tangelos, turmeric, turnips, tzatzikihili, watermelon, walnuts, yams, zespri.

In the database table, the colors of yellow, blue, green and grey indicate soil orders. The commonly grown produce is indicated by colors for each soil order in the database, meaning that two or more farms have been raising them. The non-colored crops, or as we call them, the uncommonly grown produce, means that only one farm in each city on the latitude has grown them. Sample size of farms in this database is from one to six depending on the latitudes and the expanse of the soil orders. The uncommonly grown produce would thus become prospective new candidates in any organic farms around the world. There are produce underlined in the table illustrating the same produce has been growing both in 20th/40th parallel north/south. This is because the mean air surface temperature measured at a standard height of 1.2 m (4.0 ft) above the ground surface on the 20th/40th parallel north/south is about 12.5 degrees/25 degrees centigrade (Figure 2) (Roper, 2016). The precipitation at the 20th/40th parallel north/south is about 27.5 kg/square meter/17.5 kg/square meter (Figure 2).

The results in the database clearly illustrate trends that in both 20th/40th parallel north/south almost the same produce can be grown in the same soil orders (Table 2).

Database table viewpoints are:

• Percentage in parenthesis of the top line shows global ice-free area in each soil order.

• Produce names are indicated in alphabetical order.

• Commonly grown produce is indicated by colors for each soil order and latitude in the table meaning that two or more farms have been raising them in representative cities shown in the left column.

• Underlined produce is grown in the same north/south latitudes and in the same soil orders.

• Non-colored produce, the uncommonly grown produce in the table meaning that only one farm in each city in the same latitude and in the same soil orders has grown them.

• Uncommonly grown produce indicated in the database would become new produce candidates in any organic farms around the world in the same latitudes and in the same soil orders.

A flow chart to find new produce candidates in any farm around the world is illustrated (Figure 3).

The flow chart viewpoints are:

• First of all, farmers should know the latitude and soil orders of their farms by seeing the world map and the soil orders (Smith, 1999).

• Then see the database to retrieve produce which can be grown in their farm's latitude and soil orders.

• Find produce without colors and underlines in the database.

• After trying test growing in their farm, they can get the new produce in the end.

DISCUSSION

1. New produce candidates discovery in organic farms around the world: Some organic farms in Japan are selected to confirm (Figure 3). They are Furuba Farm in Nagano prefecture, Norma Farm in Aichi prefecture, Goen Farm in Gifu prefecture and Organic PGS Hiroshima farm in Hiroshima prefecture.

Their farms are located in 40th parallel north. The farm's present produce and soil orders are summarized (Table 3). When comparing Tables 2 and 3, almost all of the present produce in Japanese organic farms are the same as indicated by color of yellow/green for farms covered by entisols or inceptisols soil orders. New produce candidates are also shown (Table 3).

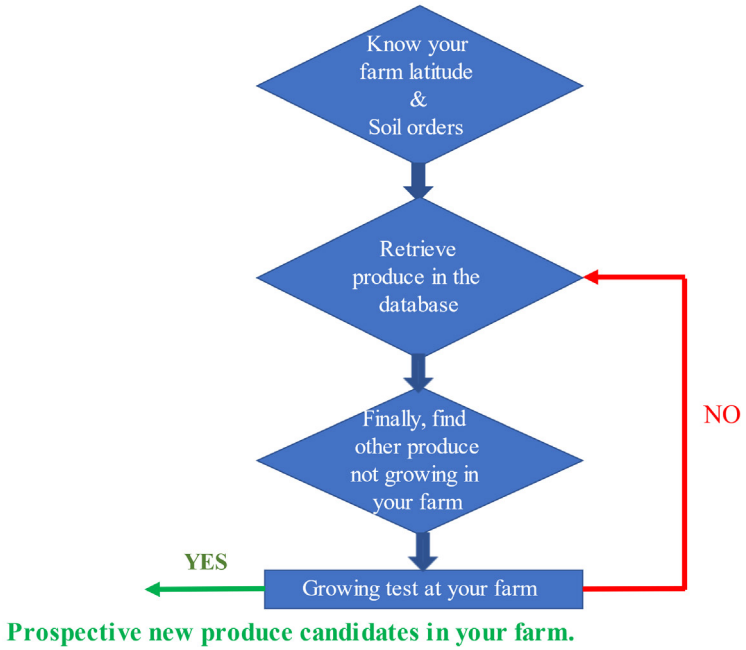

Figure 3. Flow chart to find new produce in your farm.

Table 3. New produce confirmation in Japanese organic farms located in 40th parallel north (Note: Colored produce is found in the database in Table 2).

Farm name (soil orders)	Present produce	New Produce candidates in the farm
Furuba farm (entisols)	Beans, cabbages, carrots, cherry tomatoes, crown daisy, cucumbers, eggplants, Jew's mallow, leeks, lettuce, potatoes, potherb mustard, pumpkins, radish, Snap pea, spinach,sweet peppers, sweet potatoes, turnip	Arugula, broccoli, coriander, corn, garlic, okra, onion, peanuts, snow pea, tomato, zucchini
Norma Farm (entisols)	Air potato, ajime pepper, artichoke, arugula, asparagus, avocado, basil, beets, Bitter Gourd, black soybeans, bok choy, broad pea, broccoli, butter nuts, cabbage, chamomile, carrots, cauliflower, chestnuts, chicory, Chinese water spinach, Citrus sudachi, curry tree, coriander, corn, crown daisy, cucumbers, dill, eggplants, endive, fennel, figs, flat lemon, garlic, ginger, green beans, green pepper, horseradish, Indian spinach, Japanese mustard spinach, Japanese pepper, Japanese plum, Jerusalem artichoke, Jerusalem crown daisy, Jew's mallow, jujube, kale, kaffir lime, kumquat, Kohlrabi, leaf Chinese mustard, leeks, lemon, lettuce, Manganji-temple sweet pepper, melons, Mignonette-vine, nankin cherry, Nanko-ume plum, Okinawan spinach, onion, okra, oriental melon, parsley, pawpaw, peaches, pears, peanuts, peril, Perilla, persimmon, pomegranates, potatoes, potherb mustard, pumpkins, purple yam, purslane, radish, red pepper, romaine hearts, roselle, salad, Snow pea, snap pea, soy beans, spinach, Sumo Mandarin, sweet potatoes, swiss chard, Tatsoi, taro, tomatoes, turnip, wasabi greens, watermelon, Wax gourd, yacon, yam, yuzu, zucchini	Celery, chard, peas, pepper, apple, beans, cherries, chestnuts, Lombard pea, loquats, mangoes, shiitake, oranges, pistachios, quince, red chili, sweet pepper, sorrel, strawberry, turmeric, vine leaves
Goen Farm (entisols)	Bok choy, carrots, cherry tomatoes, cucumber, cabbage, Chinese cabbage, crown daisy, eggplant, green soybeans, Indian spinach, Japanese mustard spinach, Japanese turnip green, kidney bean, leaf lettuce, leek, okra, onion, peanut, potatoes, potherb mustard, pumpkin, radish, red beans, rice, sesame, sesame leaves, soybeans, sweet corn, sweet pepper, taro, tatsoi lettuce, tomatoes, turnip, sweet potatoes, water convolvulus, wild sesame, zucchinis.	Artichokes, asparagus, broad beans, celery, chard, corn, figs, garlic, grapes, peas, watermelon, arugula, beets, broccoli, cauliflower, cherries, chestnuts, endive, fennel, ginger, lombard pea, loquats, melons, shiitake, oranges, pak choi, peaches, parsley, pomegranates, purslane, red chili, swiss chard, sorrel, spinach, strawberry, turmeric, vine leaves.
Organic PGS Hiroshima Farm (inceptisols)	Apple, asparagus, bell peppers, blueberry, broccoli, cabbage, cauliflower, carrots, celeriac, celery, chard, chestnut, chicory, Chinese crown daisy, chives, chrysanthemum, corn, Cucumber, eggplant, escarole, fennel, figs, garlic, grapes, green peas, gingko, green onion, green soybv	Alfalfa, avocado, bulb mask, brussels sprouts, four legged beans, hemp, lemon, mango, orange.

These candidates have been chosen from uncommonly grown produce in the database. In this way any farmers around the world can discover new produce appropriate for their farms by using the database. And besides, all organic stakeholders can exchange yield protocol sets via peer-to-peer communications of the internet.

2. Sustainability: Sustainability is one of the most important elements of ORGANIC 3.0 (Rahmann, et al. 2017). The database can contribute to help farmers find new organic produce appropriate for their farms. This facilitates the crop rotation to improve soil characteristics by maintaining soil bacteria. Because, farmers can select a wide variety of produce from the database. In this way, organic farmers can grow various kinds of produce for future generations continuously. At the same time, they can satisfy the requirements of earth-friendly organic farming.

3. Economy: The database covers various kinds of organic produce around the world. So, farmers located in the same latitudes with the same soil orders can successfully try out new crops economically and easily as in 1. above. This also contributes to an increase in the number of organic farmers and an increase in the number of conversions from the conventional farming to the organic farming.

4. Even today the organic land share even today the organic land share is only 1.5% of the entire arable lands in the world (Willer, et al. 2021).The database provides a good environmental protection movement with the augmentation of plentiful organic produce in the world.

CONCLUSIONS

A Simplified proposed OSI Reference Model of Organic Agriculture clarifies the organic produce growth protocols. The database is constructed based upon key protocols; latitude, soil orders and produce in the reference model. Farmers can find new produce candidates in their farms from the database. This has been confirmed by Japanese organic farmers as well. Therefore, the database would contribute to increase the new organic produce varieties and yields globally. The database would provide good suggestions for farmers to try out new produce in their farms. Furthermore, stakeholders in different countries can exchange yield relevant information via the peer-to-peer internet communications. The database would design for organic produce will contribute to the acceleration of IFOAM ORGANIC 3.0 in terms of organic farming, its sustainability and the relevant parties inclusiveness.

FUTURE WORKS

The database is not exhaustive at this point in time, because desirable produce might change according to the traditional national diet cultures, consumers' taste, farmers' efforts and global warming. Therefore, every year we will need to revise the database. It would be necessary to publish a yearbook of the organic produce database through the cooperated efforts of farmers around the world (IFOAM, 2020) and update it annually using the peer-to-peer communications (Computer Hope, 2018) by the Internet. The periodical exhaustive database updates should be conducted by IFOAM-Organics International, IFOAM Asia and FiBL to increase produce data and accuracy with other soil orders as well.

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CONFLICT OF INTEREST

We have no conflict of interest in the contents writing of this paper.

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