

## Description of inventory methods for plants in agroecological crop association

Descripción de métodos de inventarios para plantas en asociación de cultivo agroecológico

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### RESUMEN

La agricultura orgánica se basa principalmente en el estudio de las influencias mutuas de los organismos vivos y su entorno para explotar los beneficios que estas influencias pueden traer. La naturaleza se manifiesta en su estado primitivo como comunidad vegetal. La asociación de cultivos significa la siembra simultánea de varias especies en la misma parcela o sector específico de siembra, imitando así la diversidad natural. Por lo tanto, las diferentes especies estarán sujetas a condiciones de riego, arado, fertilización, etc. Ambas cosas. El resultado final de las asociaciones puede ser favorable o no favorable. Es por eso que se debe investigar con mucho cuidado sobre las plantas que se plantarán al mismo tiempo, cuanto mayor es la diversidad de plantas en un ecosistema, más estable es, por lo que cada planta debe integrarse en un equilibrio dinámico en el espacio a través de enlaces y en el tiempo de tránsito.

**Palabras clave:** Inventarios, métodos, agroecológicos, asociados, gestión

### ABSTRACT

Organic agriculture is mainly based on the study of the mutual influences of living organisms and their environment in order to exploit the benefits that these influences can bring. Nature manifests itself in its primitive state as a plant community. Crop association means the simultaneous planting of several species in the same plot or specific planting sector, thus imitating natural diversity. Therefore, the different species will be subject to irrigation, plowing,

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REVISTA TECNOLÓGICA  
ciencia y educación  
Edwards Deming

ISSN: 2600-5867

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Edited by: Tecnológico Superior Corporativo Edwards Deming  
January - March Vol. 6 - I - 2023  
<https://revista-edwardsdeming.com/index.php/es>  
e-ISSN: 2576-0971  
Received: November 22, 2022  
Approved: December 28, 2022  
Page 56-66

fertilization, etc. conditions. Both. The final result of the associations can be favorable or unfavorable. That is why you should research very carefully about the plants that will be planted at the same time, the greater the diversity of plants in an ecosystem, the more stable it is, so each plant must be integrated in a dynamic balance in space through links and in transit time.

**Keywords:** Inventories, methods, agro-ecological, associated, management

## INTRODUCTION

Currently, agricultural production is based on a simplified model of agro-ecosystems with monocultures, despite the fact that biodiversity is necessary for food security of the population. The consolidation of this reductionist approach, heavily dependent on chemical inputs, has contributed to soil deterioration, water pollution and even health problems. Cultivated plant communities are an alternative to this approach, as they have several advantages over single-seed based systems. Some studies have increased crop (Ebel et al., 2017; Molina Anzures et al., 2016) and animal (Rivera et al., 2015) productivity, improved income (Aguirre, 2017; Rezende et al., 2009), Climate Conservation (Alegre, 2017; Palm et al., 2002), Water Optimization (Chamorro Viveros and Rey, 2017; Morales Rosales et al., 2006),

Increased Soil Fertilization (Navas Panadero et al., 2020) Vera, 2017) and family well -ser (Vásquez González et al., 2018). Crop association offers an alternative for improvement in the social, economic and environmental spheres.

The idealization of this article is to provide information about intercropping, as it has several benefits over a system based on a single seed. For the publication to be presented will provide information and ideas to carry out a good management of that, also will be given information on management tool used to record the quantities of existing goods, what we call this inventory methods and how to take better advantage, either qualitatively or quantitatively.

The following article describes inventory methods for plants in agroecological crop association (purple cabbage (*Brassica oleracea*), white bean (*Phaseolus vulgaris*), bell pepper (*Capsicum annuum*), carrot (*Daucus carota*) and onion (*Allium cepa*)), in order to obtain data that can benefit the associated agroecological crops.

The problem present in this research is the scarce control of the application of inventory methods for plants in agroecological crop association at the "Dr. Jacobo Bucaram Ortiz" miracle farm.

It is necessary to learn to identify the main inventory methods for crop association, whether qualitative or quantitative. This article tries to show the main methods that can benefit the crop association with a good inventory technique.

The present article will be carried out with the purpose of knowing an appropriate inventory method to carry out a good management of agroecological crops for farmers and those readers who cannot keep track of the products that enter and leave a warehouse.

There are different tactics to maintain a good inventory of either qualitative or quantitative analysis, through this article will detail useful methods of proper planning to avoid wasting time and effort to collect data that then have no great utility or do not give answers to the original objectives of the research, you should consider the key elements.

Inventories have usually aimed to list exhaustively the plant species present at a site. Inventories can also be designed to determine the number of individuals of one or a few individual species, they can also be designed to evaluate the ways in which species are specially and temporally distributed in a region, the beneficiaries of this article will be the readers helping them to know a little more in depth all related to inventory methods to maintain an improvement in the control of products.

Purple cabbage is also known as red cabbage, red cabbage is a vegetable native to Western Europe. According to studies, purple cabbage is rich in vitamin C, citric acid and sulfur compounds and has laxative properties due to its fibrousness. These and other properties germinate in Avila's soil for the benefit of the economy and the national production boom.

Chemical composition of red cabbage:

Water 91%, Carbohydrates 5%, Fiber 1%, Proteins 2,6%, Lipids 0,2%, Potassium 210 mg/100 g, Phosphorus 23 mg/100 g, Calcium 42 mg/100 g, Iron 5 mg/100 g, Vitamin C 46 mg/100 g, Vitamin A 6 mg/100 g (Cozo, 2020).

This plant belongs to the cabbage family is characteristic for its color, has many uses in gastronomy for its components and properties, for being a vegetable tends to be horticultural, for its growth requires various essential nutrients in the soil, it needs regular and constant irrigation for their respective development.

It is a biennial plant. The root is pivotal provided with a series of abundant rootlets. Its leaves are reddish, lobed, broad and covered with a glaucous purine. The apical bud is atrophied and for this reason, the leaves form a tightly packed leaf bud where the guard will accumulate reserves. The second year, after receiving the vernalizing temperatures, it mobilizes the reserves and emits a floral thalamus that reaches 0.5 to 2 m in height. Its fruit has the shape of a siliqua, inside which there are numerous rounded seeds. In 1 gram there are between 350-400 seeds.

The germination capacity of these seeds is 4 years. Therefore, it is a botanical variety that is cultivated for its cozy head. Within the cabbage cabbage, or commonly cabbage, two forms are included by the color of their heads: Forma rubra (L.) Tell. - purple or red cabbages, usually known as Lombard or purple cabbages. (Agroes.es).

The white bean is a leguminous plant which is considered to be a dry grain, for the cultivation of this plant is considered that the soil should have a pH ranging from 6.5 to

7.5. Fertilization is related to the content of N and P, since they are elements of greater demand in its cultivation.

The irrigation activity is not a usual practice by bean producers, but with the implementation of small irrigation systems in the different agricultural areas of the country, it has been found that beans are an alternative production either for export grain or seed production.

Pests are limiting factors in bean production since they can attack all plant organs during the growth and reproduction stage, causing damage directly and/or in association with pathogens.

White beans in Ecuador are characterized by their white color, oval shape and semi flattened. It is consumed dry and tender, and is grown in Azuay, Loja and Chimborazo. (Pucuji, 2016).

The stem and branches end in a developed inflorescence, when this inflorescence is formed, the growth of the stem and branches usually stops. The stem is strong, with a low number of nodes (five to ten). The height can vary between 30 and 50 cm; there are cases of dwarf plants (15 to 25 cm). The flowering stage is short and the maturity of all pods occurs almost at the same time. Internodes are longer, more numerous and in some cases with climbing ability.

Vegetative phase begins when the seed has favorable conditions to germinate, and ends when the first flower buds appear, in this phase most of the vegetative structure that the plant needs to start its reproduction is formed. However, the reproductive phase is when the flower buds or clusters appear and the crop matures.

The bell pepper plant (*Capsicum annum*) is herbaceous and has vertical stems with a variable height of 0.5 to 1m. Its roots are deep and its leaves are long oval and dark green in color. It has solitary flowers that are grouped in groups of 2 to 3 and its petals are white and white. (Borbor, 2007).

The polymerization is of low temperature during the development of the flower bud that varies between 15 and 10°C, forming a flower with the following anomalies: its petals are curved and without progress, forming multiple ovaries of which grow in a shortened way and thickening in its ovary and pistil, etc. (Pepper cultivation, 2020).

Bell pepper is a species with moderate tolerance to salt as well as to irrigation water, similar to tomato but in a lower proportion. That is why the *Phytophthora* fungus lives in the soil, so it is advisable to disinfect the area before planting.

The optimum relative humidity is between 50% and 70%, the humidity is very high in which large diseases that hinder fertilization develop. On the other hand, the luminosity helps its development during flowering.

The most suitable soils for bell pepper cultivation are sandy loam, deep, rich, with an organic matter content of 3-4% and mainly well drained. most suitable soils for bell pepper cultivation are sandy loam, deep, rich, with an organic matter content of 3-4% and mainly well drained.

Annual or biennial, native plants up to 1.6 m tall, cylindrical, conical or round, napiform, white, reddish yellow or orange-yellow roots, isolated, cylindrical, fluted, much branched

and branched stems. Leaves are ovate, 5-15 x 2-7 cm, straight to lance-shaped segments and petioles extending 3-10 cm to the base. 3-7 pairs per leaflet segment, 1 terminal, linear lanceolate, 2-12 x 0.5-2 mm, margins entire or serrate, apexes acute mucronate, especially veined and margins with a mysterious sheen.

The flowers are 3-10 mm peduncles, with up to 20 peduncles in umbels and 25-60 cm long fluted peduncles. Bracts involved in folic acid are fibrous, 3-30 mm long and reflexed. Lineation of bracts linear, pointed and ciliate. Petals are colorful in white, yellow, pink and purple. The schizocarp is ovate, ovate, 3-4 mm long, about 2 mm in diameter, and the veins are covered with spines and stiff hairs. The seeds are oval, 2-3.5 x 1-2 x 0.8-1 mm, yellowish gray or brownish spiny.  $2n = 18$ . It is cultivated for its edible roots and also as food. From the roots, you get food coloring. The seeds are fragrant and you can get the essential oils.

Carrots prefer a warm climate, but they are unpretentious plants. Prefer clay-limestone soil. Breathable, cool, rich in well-decomposed organic matter and potassium, pH 5.8-7. Repeat crop of carrots is not recommended for at least 4-5 years, as it is very hard on the soil. Sunflowers, potatoes, tomatoes and onions are recommended preliminary crops. Soil preparation: this usually consists of deep cultivation (relaxing or storage) followed by shallow cultivation or cultivation.

The nursery is prepared with a suitable cultivator and molder. Sowing: It is normally done with pneumatic seeders and seedless seeds or in calibrated strips at a rate of 1.8 million to 2.3 million seeds per hectare. Irrigation: Irrigation is very difficult during summer cultivation, especially in dry soil.

Fertilization: Poor soils, per hectare: manure (30 T), 33.5% ammonium nitrate (100Kg), 18% lime superphosphate (400Kg), 50% potassium chloride (150Kg). Rich soils, per hectare: 33.5% ammonium nitrate (100 kg), 18% lime superphosphate (300 kg), 50% potassium chloride (150 kg). Potassium chloride and lime superphosphate are incorporated into the soil before winter. The blanket nitrate, in one or two times after thinning. (Traxco, 2019).

Onions are one of the world's most widely grown vegetables with a geographical distribution, area and per capita consumption are typical winter crops and are well adapted to certain semi-desert areas. The edible part of this vegetable is the ripe bulbs, but its leaves can also be used when they are tender. Since onions are widely used in the home, they can be harvested as bulbs or in bunches, making them ideal for home gardens. This is a very popular crop in the world due to the large number of varieties that have diverse adaptations to the climatic differences that affect the vegetation.

Onions have a root system consisting of many shallow white roots that grow from a disk-shaped body called a calidiscus. The disk of this stem has many nodes and internodes (very short) from which the leaves grow. The leaves have two clearly differentiated parts: the base part formed by the leaf sheath thickened by the accumulation of reserve and the terminal part formed by the green "phyllode" (the color can be different). The thickened leaf sheath forms a "doublet" of tubers, the outermost of which is parchment-

like in nature, protective and gives the tubers a unique color. The plant has fused leaf margins and looks like hollow leaves.

Leaves are arranged alternately. Quality: Tubers should be of suitable shape and size (normal diameter  $\pm 10$  cm), weight 200g-400g.

Not all countries cover their needs and are forced to import part of their consumption. temperature The range is from 10 to 25 °C and the optimum is 15 to 20 °C. It is frost resistant and requires a temperature below 14-16 °C to start flowering. The range is 10 to 35 °C, and the optimum is about 18 °C. Best yields are obtained in regions where the maximum temperature does not exceed 26 °C. As a general rule, lower temperatures are preferred at the beginning of growth and higher temperatures closer to maturity. At the beginning of bulb formation a temperature of 15.6-25 °C is required (Benacchio, 1982).

Before bulb formation, temperatures below 18 °C are required. Vernalization is not necessary for bulb formation, but it is necessary for seed production. The critical freezing temperature is -2 °C. During bulb formation, a temperature of 18-25 °C is required and the maximum temperature does not exceed 35 °C. The minimum threshold is 2-5 °C

## MATERIALS AND METHODS

Different sources of information were used in this article: master's theses, web pages, company articles. However, bibliographic studies review, classify and use existing information from a variety of valid sources for research.

Compared to explanatory research, descriptive research is based on pointing out certain characteristics of the study, focusing more on the "what" "why" which is the subject of such research, which encompasses the design.

In different words, its purpose is to describe the nature of a demographic segment by collecting quantifiable information without focusing solely on the reasons why the phenomenon occurs. Descriptive research does not alter any variable of a certain phenomenon, but is limited only to describing them.

It is important to know that the planning of an inventory must consider two key elements: to be clear about the purposes of this research and to know the biological system(s) with which one is going to work, and to choose the sampling methodology, which involves not only the sampling procedure but also how to carry it out.

It is characterized by the use of secondary data as a source of information. The purpose of this publication is to obtain a database of plant diversity inventory methods. It is important to know that inventory planning should take into account two main factors: to be clear about the purpose of this study, to know the objects you will be working with and to choose a sampling method, which is related not only to the sampling procedure, but also to its application.

The descriptive method is one of the qualitative methods used in research to evaluate some characteristics: it allows obtaining a lot of precise data on the object of study, it implies attentive observation and a faithful record of what is observed, it does not admit generalizations or projections and it uses different techniques and instruments for data

collection: interviews, surveys, documentation, participant observation, etc. The descriptive method guides the researcher during the scientific method in the search for answers to questions such as: who, what, when, where, when, where, regardless of the why.

The descriptive method was used to describe the inventory methods for plants in the agroecological crop association.

The explanatory method will allow the researcher to become familiar with the subject to be examined and to design theories to test them. This method is very valuable for social research. They are essential when one wants to convey new data from the research point of view.

In the bibliographic work, reading techniques will be used in the search for information on websites and in digitalized books to obtain the topics related to the association of agroecological crops with technical concepts, summaries of practices and scientific definitions. The paraphrasing technique coordinating that when a text is not clear the idea is explained, this time with the writer's own words.

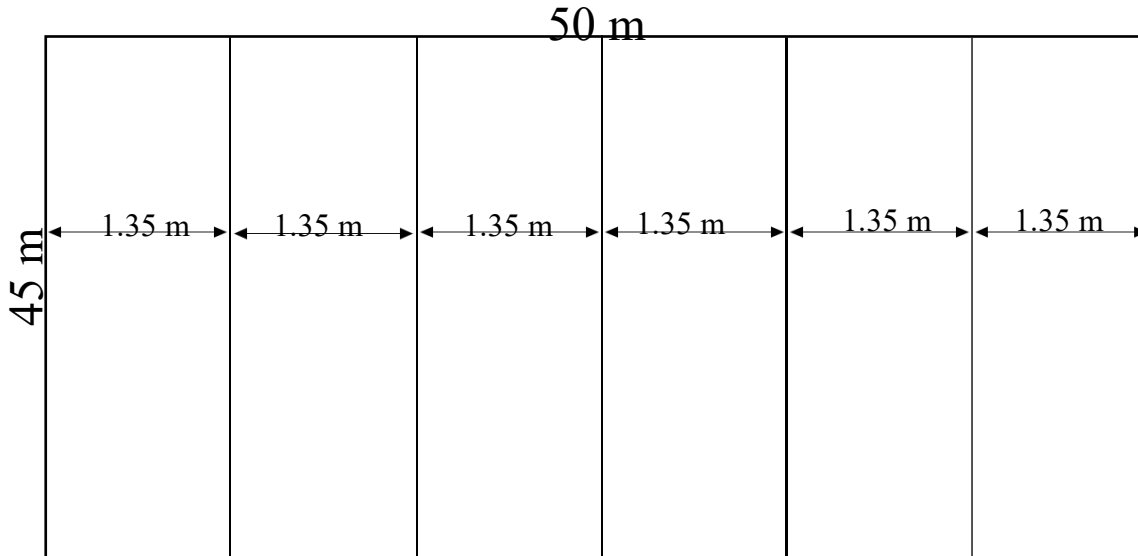
This is characterized by the use of secondary data as a source of information.

For plant inventory methods generally aim to list the full range of plant species present at a site. However, an inventory can include much more, as it is a single measurement of one or more components of the plant biodiversity of an area.

## RESULTS

The work was carried out at the "Dr. Jacobo Bucaram Ortiz" miracle center, proceeding with an analysis of surface measurements for crop association and good agroecological management.

The surface measurement is (45x50) m. Understanding the needs of each crop in its spacing and temperature (See Figure 1).

**Figure 1** Work area where associated crops will be planted.

Source: Velez, 2022

To calculate how many rows or plants we will have in a row, or the density of plants in a given area, we will do the following example:

We have an area of 45x50 m where a farmer wants to plant onions of which the distance between rows and between plants is 1,35 m and 0,10 m. The farmer wants to know an average of how many plants can fit in that area.

First way how to perform this example

$$\rho = \frac{Area^2}{distancia\ entre\ surco \times distancia\ entre\ plantas}$$

$$\rho = \frac{45m \times 50m}{1,35m \times 0,10m}$$

$$\rho = 16666$$

This form indicates the density of plants that will be in the farmer's area.

Second form

$$surcos = \frac{m\ de\ largo}{m\ de\ entre\ surcos}$$

$$surcos = \frac{50m}{1,35m}$$

$$\text{surcos} = 37$$

$$\text{plantas por surco} = \frac{m \text{ de ancho}}{m \text{ entre plantas}}$$

$$\text{plantas por surco} = \frac{45m}{0,10m}$$

$$\text{plantas por surco} = 450u$$

$$\text{Plantas}_t = \text{plantas por surco} \times \text{surcos}$$

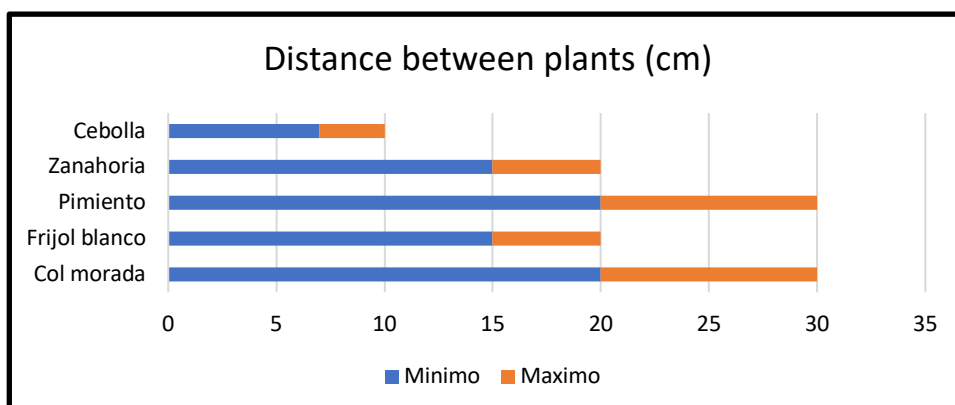
$$\text{Plantas}_t = 450 \times 37$$

$$\text{Plantas}_t = 16650u$$

These two forms help to have a better organization in the inventory method either in species list or other methods and in the accounting of all our crops. However, for associated crops it is advisable to use the second form as it is more specific to each furrow because the crops are intercropped.

Onions need 7 to 10 cm between plants, carrots 15 to 20 cm, peppers 20 to 30 cm, white beans 15 to 20 cm and purple cabbage 20 to 30 cm between plants. However, this may vary if an irrigation system is used or not (see Figure 2).

**Figure 2** Distance between plants



Source: Velez, 2022

## DISCUSSION

Crop association is a very important tool in Agroecology since it is based on the development and growth in a natural way, taking into account the planting of several species at a certain distance, with the aim of helping each other by exchanging properties and nutrients, also helping to keep the soil fertile, both in pest control and weed control, taking into account the care in the environment for the conservation of water, soil and air, without forgetting, bearing in mind the sustainability and sustainability.

Whenever you have to make an inventory, you should always collect data on what you currently have; whether it is to know how many plants you have of each crop in the hectares to be mentioned or what they produce in so many hectares of the selected crop such as cocoa. The two methods that have been given as examples to have an inventory in perennial (permanent) crops, give more accurate results than short cycle crops.

The models of excellence, invites to learn about the activities of the cluster, how it is being managed, by cultivating crops with a wide diversity of species. Thanks to the help of biodiversity inventories through technical and scientific methods, it was possible to reach the conclusion that the great variety of species diversity is the primary source for the process of crop evolution. Within the satisfactory area, with a relevant aspect that is the credibility of each inventory with a high percentage of yield in the different varieties of species.

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