

SYNSEPALUM DULCIFICUM (Schumach. & Thonn.) Daniell



A MONOGRAPH

Federico Holguin
Agricultural science
2017-2018

TABLE OF CONTENTS

TABLE OF CONTENTS	2
1.0 INTRODUCTION	2
2.0 ECOLOGY	3
2.1 DISTRIBUTIONAL CONTEXT	4
2.1.1 Affinity and origin	4
2.1.4 Present distribution	4
2.2.2 Climate	5
2.2.4 Geology and Soils	5
2.3 SITE	5
2.4.3 Parasites	6
3.0 BIOLOGY	6
3.1 Chromosome complement	6
3.2 LIFE CYCLE AND PHENOLOGY	7
3.2.1 Life cycle	7
3.2.2 Phenology	7
3.2.2.1 Flowering and fruiting	7
3.3 REPRODUCTIVE BIOLOGY	8
3.3.1 Pollen	8
3.3.2 Sexuality	8
4.0 Propagation and management	8
4.1 Natural regeneration	9
4.2 Nursery propagation	9
4.3 Planting	10
4.4 Management	11
5.0 Marketing and economy	11
5.1 Major distributors	12
5.2 Products	12
5.3 Nutritional value	12
5.6 Other uses	14
Bibliography:	14
	2

1.0 INTRODUCTION

The use of *Synsepalum dulcificum* in industry has a key component (Miraculin) which has been of great influence in changing the flavour of sour foods (Fooladi, n.d.). Previously used by the native Africans by sweetening stale bread, soured palm wine and pito which is a beer made up of fermented grain (Fooladi,n.d.). Miraculin the key component of the miracle berry has some particular rare qualities perceived by the human tongue, which changes sour tastes to sweet due to the glycoprotein that it contains, consisting in sugar, glucosamine, and fucose (Izawa, 2010). Although it has been shown that growing the plant has a lot of complications it is a fruit that has lots of potential in the market and in the creation of different flavors within the same plant (Ogunsola & Llori, 2007) . This product in the market will become a great initiative for people that are starting a diet or becoming fit for their wellbeing. Since this product is a replacement for fructose and other products that make the taste of foods and drinks become less acid or sour. *S.dulcificum* is a simple additive that eliminates the acidity of any type of food.

Chapter two explains the location of the world in which the plant grows best. It is necessary to understand where the plant grows best in order to have a wide analysis of the subject and be able to get the best information from the sites with the most concentration of the berry. The different locations also help us understand the different varieties and taste because of the type of soil or climate. Chapter three gives an explanation in the life of the plant, its properties, genetics, life cycle, and how the plant propagates. Chapter four is the necessary chapter to be able to grow the plant, and under what necessary conditions the plant has to grow in. This chapter also gives a step by step in how to grow the plant from the planting until it starts producing. With the examples from chapter five specifics will be found on the positive selling aspects of the taste properties of the pulp of the fruit (Nijideka, Ubbanou, Serah, Chioma, & Munachiso, 2015).

2.0 ECOLOGY

The miracle fruit known as the miracle berry (*Synsepalum dulcificum*) was first discovered in tropical west and central Africa as can be seen in Figure 1 below. Which best adapts to hot, wet tropical lowlands (University of Connecticut, 2017). It is an evergreen tree that grows up to 5.5 meters, in its natural habitat. *S.dulcificum* has suffered from different climate changes which have made propagation problematic for the species.

2.1 DISTRIBUTIONAL CONTEXT

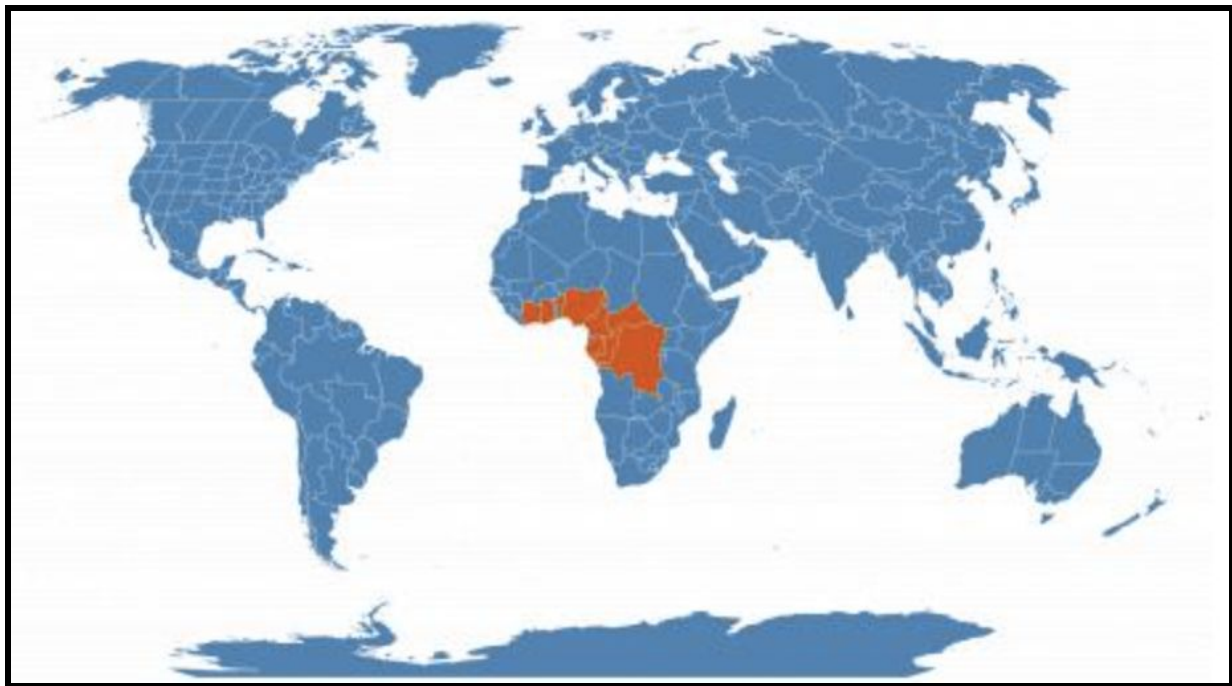


Figure 1. Distributional map of *Synsepalum dulcificum* (University of Connecticut, 2017)

2.1.1 Affinity and origin

Synsepalum dulcificum is a member of the Sapotaceae family, Chrysophylloideae as the subfamily, in the division of Magnoliophyta and of the class Magnoliopsida (University of Connecticut, 2017). The plant still has no suborder, tribe or subtribe based on the characteristics of the plant (Inglet & May, 1968).

The plant originated in tropical west Africa, from Ghana to the Congo.

2.1.4 Present distribution

Synsepalum dulcificum firstly discovered in tropical central africa and then propagated to many south asian countries, Australia and US (Ho Dinh, 2016). The propagation of this fruit has been due to the need of the taste properties it offers. After propagation of *S.dulcificum* to the United States it has been represented that the plant is intolerant to frost, best adapts to Taiwan, Jamaica, the south of U.S (best in Florida) or Hawaii. The fruit has been now known to be propagated by the United States department of agriculture, and federal experiment station in Puerto Rico. (G.E & May, 1968). The plant has deep green leaves with a hairy form. It has white flowers that are small .6 centimeters, this produce the miracle berry. The fruit measures between 2 to 3 centimeters with a bright red colour (University of Connecticut, 2017).

2.2.2 Climate

Weather in western central Africa rises from 30 to 40 degrees celsius. This is due to many factors such as the position close to the equator making it very tropical, humid and constant rainfall. The only season that temperatures start to rise and the air becomes more dry is between June and October but the adaptation of the plant has made it possible to survive 4 months at these high temperatures. *S.dulcificum* is more propense to survive under conditions of heat rather than frost, frost can not be tolerated by the plant. (Lonely planet, 2017)

2.2.4 Geology and Soils

Synsepalum dulcificum needs to be planted in acidic soils, with a pH between 4.5-5.8(University of Connecticut, 2017). This acidity level can be obtained by planting different species of pine and acid peat which help maintain a stable acid pH level (Daniell, 1996). When the plant is planted in areas that do not have the perfect conditions for the plant there is no possibility of the plant producing the berry (University of Connecticut, 2017).

2.3 SITE

Synsepalum.dulcificum has a range of places that it can grow. Depending on where and how the plant is planted it will produce more berries and be taller. If the seed is planted in a pot where it

is humid or hot, or with a high elevation the stem will rot. (Ho Dinh, 2016) The plant has to be necessarily planted either in a pot with the right specifications of needed water, and drainage or plants in soil with acidity between 4.5-5.8. Between 100-1000 meters above sea level, with a climate that varies between 30-40 degrees celcius, with a partial shade depending on the amount of sunlight in the day and the precipitation it receives can't exceed the drainage of the soil. It is necessary for the possibility of the propagation of the plant this specific environmental factors it receives. (Inglett & May, 1968)

2.4.3 Parasites

S.dulcificum suffers from various living pests that eat the stem, such as mealy bugs, spider mites and in the case of potted plants indoor pests that have the possibility of eating the plant. (Izawa, Yuzuke, Masanori, Yoichi, & Kuroda, 2010)

3.0 BIOLOGY

3.1 Chromosome complement

S. dulcificum has only been traced with one chromosome complement: $2n = 26$ (see IPCN volume 86-87; Arends, J. C., 1976). Which differs from all the other plants of this type since none have the same chromosome complement. (Burkhill, Danforth, Neuwinger, & Walker, 2018)

3.2 LIFE CYCLE AND PHENOLOGY

3.2.1 Life cycle

S. Dulcificum reproduces sexually, the sexual spores are produced via meiosis and they mature via mitosis which later transfer into the gametophytes. (Sabel, 2012) The gametophytes produce the gametes which later on in the process help to fertilize the plant and form what would be the zygote (Figure 2). The last stage of the process is the transfer through mitosis of the zygote maturing into the sporophyte. (Sabel, 2012) *S. Dulcificum* has both Female and Male reproductive organs always in use. The process of fertilization must occur through pollination done by bees in order to transfer the male gametophyte to the female gametophyte. (Sabel, 2012) The plant need a minimum of 22 months with the best conditions (watering, soil and microorganisms) to produce the best fruiting intensity.

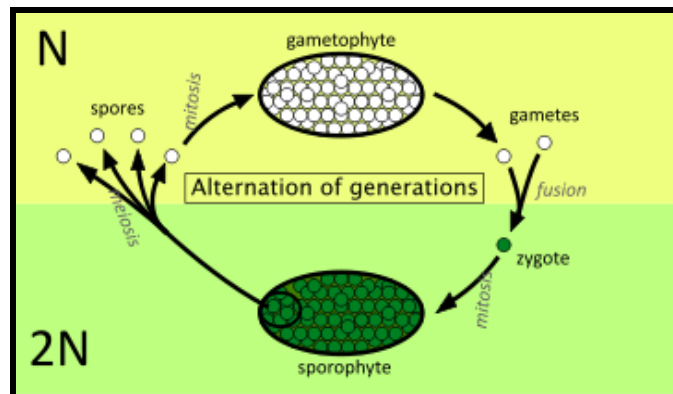


Figure 2 Representation of the life cycle process of *Synsepalum dulcificum*. (Sabel, 2012)

3.2.2 Phenology

3.2.2.1 Flowering and fruiting

As mentioned above for the plant to flower there needs to be 22 months of perfect conditions for the plant. The anthesis of the plant after pollination lasts 100 days in order for the plant to start

flowering. 40-60 days after anthesis the plant would produce fruit that is not mature enough for consumption, it needed at least 90 days to have a proper fruiting stage.

3.3 REPRODUCTIVE BIOLOGY

3.3.1 Pollen

The pollen of *S.dulcificum* is difficult to propagate and to place in the female section, the petals that are white or cream are the ones that offer the best results (Figure 3). (Cannon, 2013)

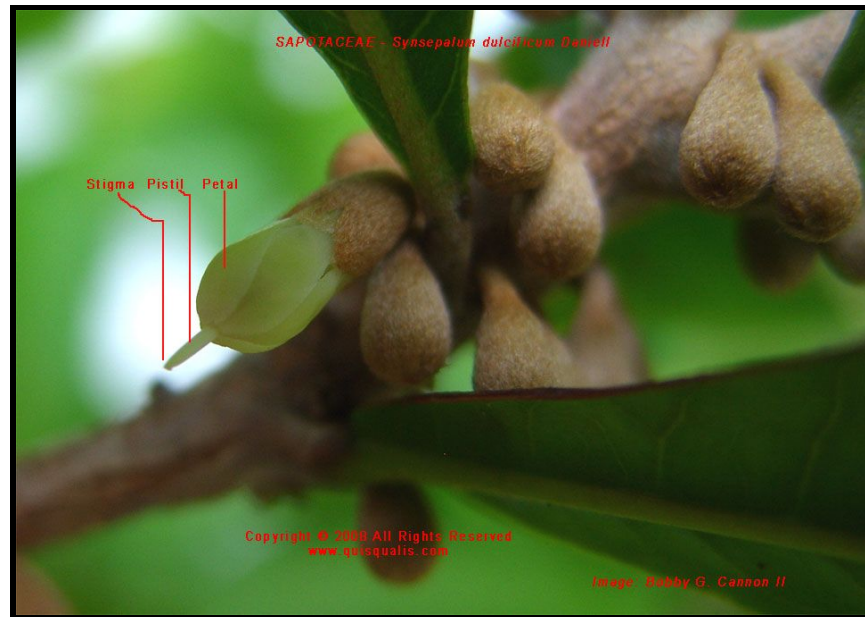


Figure 3 *Synsepalum dulcificum* flowers (Cannon, 2013)

3.3.2 Sexuality

The sexuality of *S.dulcificum* has shown that in some cases and references have shown that it is self pollinated and some have shown it is insect or animal pollinated, other have expressed that the shape and texture of the leaf and stem it pollinates through gravity from the male to female section. In order for the plant to be pollinated it needs from an outside source varying from insects to bees since the plant can not self pollinate. (Cannon, 2013)

4.0 Propagation and management

Synsepalum dulcificum is a plant that has many complications in order to produce a good amount of berry in order to have a self sustaining and profitable production. It is necessary from the moment that the seed is taken out of the shrub to have all the precautions in order for the plant to grow healthy. Following all the necessary precautions between natural regeneration, nursery propagation and how it needs to be planted and managed.

4.1 Natural regeneration

Synsepalum dulcificum has a difficult regeneration process in order for it to be able to reproduce, this is due to various factors such as the pollination (Figure 4). In order for the plant to have a natural pollinisation and regeneration it needs from a variety of plants and insects to bees because of the inability for the plant to pollinate by itself (Cannon, 2013). In order for natural regeneration to occur the plant after the seed has fallen from the shrub the seed dries very fast which means that it loses its viability. (Ogunsola & Llori, 2007)



Figure 4: Represents in which section of the plant it can be pollinated. (Cannon, 2013)

4.2 Nursery propagation

Ogunsola & Llori (2007) described how they propagated seeds:

“The embryos were cut out surgically from the seed that were already sterilized by cracking the surrounding of the seed and taking out all of the embryos.”

These embryos needed to go through the process of shooting the regenerated embryos into the nodal segments of the plant .(Ogunsola & Llori, 2007). Nursery propagation happens in a controlled environment which means that there is a high possibility to control pests and other environmental factors that may affect the growth and production of the plant. (Burkhill, Danforth, Neuwinger, & Walker, 2018)

4.3 Planting

The seedling need to be in bright filtered light, although it cannot be indirect sunlight because it will dry up the seed. There are two ways of growing the plant, in a fifteen gallon container which are in controlled environments with the necessary light for the plant with the necessary fertilizers and checkings of the quality of the soil. The other option is planting the seed in masses 2 inches apart from the other seed, when the plants are 2-3 inches tall they have to be taken out into separates pots in order for the plant to be able to survive have the correct nutrients to the soil with coconut fiber, pine bark and added perlite all with a ratio of 1,1,1. After the seeds are tossed out into the soil it is necessary for the soil to have the same conditions as it had in the pot. (Pepe's fruit trees, 2018)



Figure 5: Example of *S.dulcificum* in pots.

4.4 Management

The miracle berry has to maintain certain constants so that the production is always with the same quantity and quality so that it has the taste properties that make the plant so particular. The soil acidity has to maintain constant, this has to be done by using peat and providing fertilizer to the acidic plants that are planted near the *S.dulcificum* to maintain the constant. It is necessary for the plant to maintain a constant water flow but without getting waterlogged and developing root rot. (Patterson, 2016)

5.0 Marketing and economy

5.1 Major distributors

The major distributors of *S.dulcificum* in this date are the miracle fruit hut. They have managed to become the biggest selling and production managers which gives them the advantage of having the possibility to have sales and promotions. This company has lead in this industry due to the quality of their plants. Their products are not sold as sweeteners since they explain that the effect is known to only last 30 minutes or to a maximum of an hour and only in selected items. (Miracle fruit hut, 2018)

5.2 Products

Products have started to come in many different ways since people have become more interested in another type of flavoring that is not artificial and has taste properties that don't need artificial flavoring. The world's second largest online shopping database (Amazon.com) has a variety of products that are made of the pulp of *S.dulcificum*. Some examples of of this products are dissolvable pills to sweeten the taste of some drinks or foods. These are also sold as the replacement for gummy bears which are much more appealing to the public because of their chemical properties to change taste and after the digestion it is metabolized and turned into fat, the world is becoming fit.

5.3 Nutritional value

The fruit has been tested to have vitamin a compounds (Figure 6) which can be helpful for people that can not eat some foods such as eggs, butter, cream or dairy products since some might be dairy intolerant.

From the plant there is also the possibility of extracting vitamin E contents that can supplement the fat soluble processes in the body and certain diseases can be helped with extra vitamin e in the body to accelerate some processes such as diabetes, alzheimer's disease, and cancer. (Mohan, 2017)

One gram of the pulp of *S.dulcificum* needs to be macerated with 20 milliliters of ethanol, ferric chloride, 5 ml of water and a-dipyridyl solution to be able to extract the vitamin E content.

(Nijideka, Ubbanou, Serah, Chioma, & Munachiso, 2015)

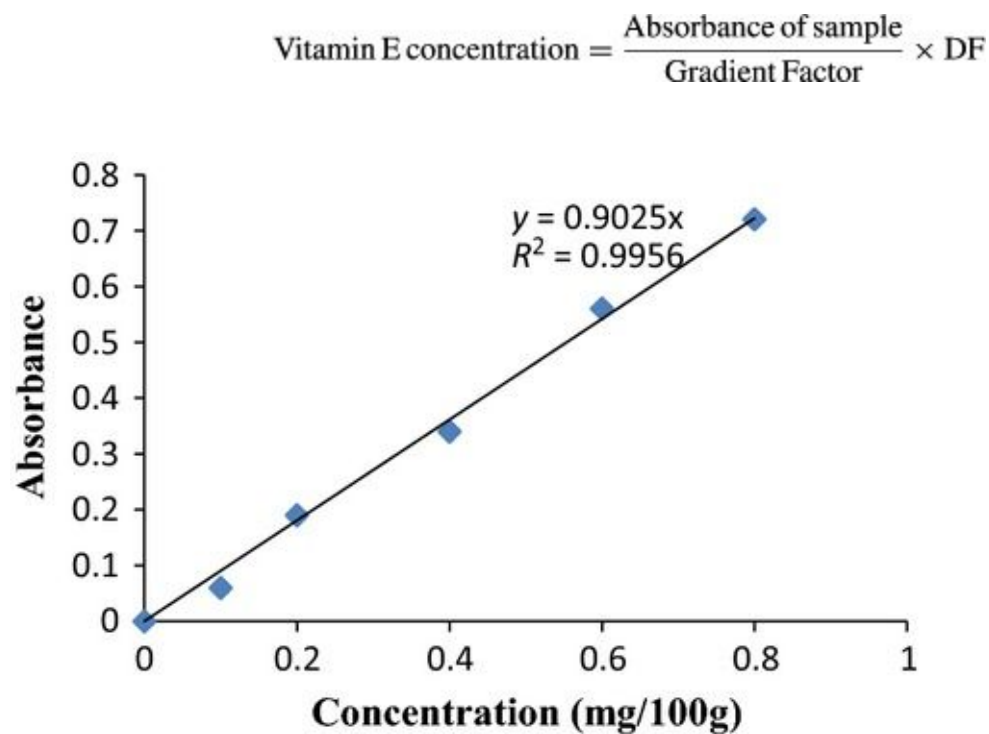


Figure: Curve for vitamin E concentrations of *S.dulcificum*.

5.6 Other uses

Apart from the taste properties that it has and all the possibilities to replace the sugar, fructose , that is so maligne for the metabolism there are other uses for the pulp and taste properties of the fruit. The fruit has protein in the pulp of the fruit making it a big selling point in the market since it can be eaten to sweeten foods and give protein for the body at the same time. This product has the ability to not need sweeteners with every coffee, lemonade, or any type of food it is only necessary to take a little portion of miraculin which will act in replacement in a lot of the artificial sweeteners that are in the market.

Bibliography:

Burkhill, H. ., Danforth, R. ., Neuwinger, H. ., & Walker, R. (2018). *Synsepalum dulcificum*.

Accessed on 2/26/2018 Retrieved from

[https://www.prota4u.org/database/protav8.asp?g=psk&p=Synsepalum+dulcificum+\(Schumacher.&Thonn.\)+Baill.](https://www.prota4u.org/database/protav8.asp?g=psk&p=Synsepalum+dulcificum+(Schumacher.&Thonn.)+Baill.)

California rare fruit growers. (1996). Miracle fruit. Accessed on 2/12/2018 Retrieved from

<http://www.crfg.org/pubs/ff/miraclefruit.html>

Cannon, B. (2013). Up close and Personal. Accessed on 3/6/2018 Retrieved from

http://www.quisqualis.com/Synsepalum_dulcificum.html

Fooladi, E. (n.d.). Facts about miracle fruit. Accessed on 12/18/2017 Retrieved from

<http://www.fooducation.org/2012/09/facts-about-miracle-fruit-miraculin.html>

Ho Dinh, H. (2016). Introduction to the species *Synsepalum Dulcificum*.

Accessed on 12/14/2017 Retrieved from

<http://www.worldwidefruits.com/synsepalum-dulcificum-miracle-fruit.html>

Izawa, K., Yuzuke, amino, Masanori, khomura, Yoichi, U., & KUroda, M. (2010). *Synsepalum*

Dulcificum. Accessed on 12/17/2018 Retrieved from

<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/synsepalum-dulcificum>

Lonely planet. (2017). West africa weather. Accessed on 12/20/17 Retrieved from

<https://www.lonelyplanet.com/west-africa/weather>

May, J. F., & Inglet, G. E. (1968). Tropical fruits with unusual taste properties. *Economic Botany*, 22, 326–331.

Miracle berry the history. (n.d.). Accessed on 12/18/2017 Retrieved from

<http://www.miracleberrypill.org/miracle-fruit/the-history>

Miracle fruit hut. (2018). Miracle fruit Hut. Accessed on 4/11/2018 Retrieved from

<https://www.miraclefruithut.com/pages/about-miracle-fruit>

Mohan, C. P. (2017, June). Vitamin E for strong immunity. Accessed on 4/17/2018 Retrieved from <https://www.webmd.com/diet/supplement-guide-vitamin-e#2>

Nijideka, N., Ubbanou, C., Serah, A., Chioma, E., & Munachiso, U. (2015, May). Food Science and Nutrition. Accessed on 4/17/2018 Retrieved from

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4431793/>

Ogunsola, K. ., & Llori, C. . (2007). In vitro propagation of miracle berry.

Accessed on 3/20/2018 Retrieved from [www.academicjournals.org/AJB\](http://www.academicjournals.org/AJB/)

Patterson, S. (2016). Miracle Berry Growing. Accessed on 3/20/2018 Retrieved from
<https://www.gardeningknowhow.com/houseplants/miracle-berry/miracle-fruit-plant.htm>

Pepe's fruit trees. (2018). The amazing miracle fruit. Accessed on 3/20/2018 Retrieved from
<http://www.miraclefruit.info>

Sabel, E. (2012). The Miracle Berry. Accessed on 3/26/2018 Retrieved from
http://bioweb.uwlax.edu/bio203/s2012/sabel_emma/growth.htm

top tropicals. (2003). Everyday miracle. Accessed on 2/20/17 Retrieved from
https://toptropicals.com/html/toptropicals/plant_wk/synsepalum.htm

University of Connecticut. (2017). *synsepalum dulcificum*. Accessed on 12/11/2017 Retrieved
from <http://titanarum.uconn.edu/199900066.html>