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# HOW TO MANAGE AN OIL PALM NURSERY: A GUIDE FOR SMALLHOLDER FARMERS

PEOPLE, RULES, AND ORGANIZATIONS SUPPORTING THE PROTECTION OF ECOSYSTEM RESOURCES



MAY 2016

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LIBERIA PEOPLE, RULES, AND ORGANIZATIONS  
SUPPORTING THE PROTECTION OF  
ECOSYSTEM RESOURCES PROJECT

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## **DISCLAIMER**

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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# 1.0 OVERVIEW

## **Who should use this guide?**

This guide has been developed for field technicians that provide information and knowledge to small holder farmers who are interested in starting their own oil palm nursery. The guide provides the basic information on how to organize, set-up and manage an oil palm nursery. Farmers that have received training on how to setup and manage an oil palm nursery can use this guide as a reference when they decide to start a nursery on their own.

## **Why is this guide important?**

It is important to set up and run an oil palm nursery in a correct way. You have invested a lot of money in the seeds. By using this guide you should be able to get strong and healthy seedlings for out planting on your palm farm so that your work and investments pay off in high productive trees.

## **How should you use this guide?**

This guide will provide you with information on how to produce strong and healthy seedlings from certified oil palm seeds. You might already know or remember some of the important technical issues on how to raise seedlings. This guide is meant to be a helping tool that you can use if you cannot remember the best way of raising oil palm seedlings. Make notes for yourself to improve your knowledge on how to raise oil palm seedlings.

# 2.0 INTRODUCTION TO OIL PALM

## Tenera and Dura Varieties

Oil palm is one of the major tree crops in Liberia with many economic benefits. Oil palm grows in all parts of Liberia. Palm oil can earn a good income for small holders.

There are two major varieties of oil palm in Liberia: the *Dura* palm and *Tenera* palm.

The *Dura* palm grows naturally in the forest. It has a thick shell around the kernel and has a thin pulp layer around shell that contains fiber and oil. This palm is called “*the local palm*”. Each fruit is made up of an oily, fleshy thin outer layer (the pericarp), with a single seed (the palm kernel), also rich in oil (kernel oil).

The *Tenera* palm is a cultivated (which means planted and cared for by a farmer) variety for which the seeds were selected and bred by researchers and companies to grow trees that yield much more than the *Dura* variety. The *Tenera* has a kernel with a small shell around it. The shell is surrounded by a thick layer of pulp that contains a lot of oil. This palm is locally called the “*Makindo*” or “*Palmbay Palm*”. Because the *Tenera* palm has fruits with a thick pulp layer, the fruits contain much more oil than the *Dura* palm.

Besides the palm fruits that contain more oil, we also want to cultivate palm trees that produce plenty of large fruit bunches in one year. This is why good planting material that develops in healthy, strong, high yielding trees is very important. \

*Tenera* oil palm varieties (“*Makindo*” or “*Palm Bay*”) have been developed by careful selection and cross breeding at research stations in West Africa, especially in Cote d’Ivoire and in Nigeria. The *Tenera* oil palm trees stay short in length when mature (about 5-6 meters high; they are called *dwarf* varieties), they yield plenty of large fruit bunches over a long period of the year, and they start bearing fruit bunches when they are 2 ½ - 3 years old. (If you ever have tried to grow a *Dura* palm: It will take up to 7 years before a *Dura* palm will bear fruit bunches).

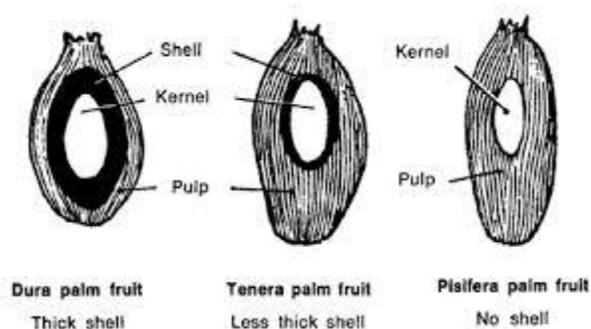


Figure 1: Fruit composition oil palm varieties  
Source: FAO

Good planting material will produce a higher yield that will last for 25-30 years. Any defect or shortcoming in the planting material will cause lower yields later in the life of the tree, and will not earn as much as the palm trees that have been grown from certified seeds from selected high yielding parent trees.

It is very important to properly manage the germinated oil palm seeds in the nursery to ensure that healthy and strong seedlings are raised for transplanting in the field. This will be the foundation of a strong productive tree that will produce fruit bunches for many years.

This guide for smallholder farmers on how to manage an oil palm nursery is specifically on the *Tenera* variety, and is meant to be used by technicians that assist smallholder oil palm farmers who are interested in growing oil palm, and those small holders that want to start their own, small size nursery. This guide provides the necessary guidance in the sourcing of your planting materials and the care of your seedlings until they are ready to be transferred to the field for planting on your palm farm.

Key points to remember:

There are two varieties of oil palm that produce fruits: The *Dura* palm that grows wild in the forest, and the *Tenera* palm that has been selected and bred for its ability to:

- (1) Stay short (dwarf);
- (2) Start producing fruit bunches after 2 ½ years, and
- (3) Yield many large fruit bunches per year.

# 3.0 WHERE CAN YOU FIND CERTIFIED PALM SEEDS

Today all modern planting material are *Tenera* palms, which is a hybrid that you get when you cross the thick-shelled *Dura* with shell-less *Pisifera*. The breeding of this hybrid can only be done at certified oil palm seed breeding facilities.

Be aware that a commercial pre-germinated certified oil palm seed (called certified seed) has a thick shell like the *Dura* mother tree, but the tree that will grow out of this seed will produce thin-shelled *Tenera* fruit. Therefore, wild *Dura* seed and certified high yielding hybrid seed look almost identical: They both have a thick shell and a modest amount of pulp of fibrous flesh that contains the oil.

The source of your planting material is very important. Make sure that all planting materials are ordered from a reputable, trusted supplier or from a renowned research institution and you must know the origin.

In Liberia, there is no research institution as of now that is producing oil palm seedlings or certified pre-germinated *Tenera* seeds. However, germinated certified oil palm seeds are mostly brought into the country from Guinea, Ghana or Ivory Coast.



**Picture 1**

Pre-germinated oil palm seeds. Pre-germinated oil palm seeds are sold in labeled bags that shows where they come from and who produced and certified the seeds. The bags contain about 1,050 seeds.

Order your seeds well in advance from the trusted supplier or from the research institution to avoid disappointment. Also, it takes about three to five weeks before the kernels are prepared at the research station to germinate. Ensure that your supplier is reputable before you buy any germinated seeds so that unscrupulous person(s) will not sell poor planting materials to you. Only certified pre-germinated oil palm seed from established trusted suppliers should be used. Therefore make sure that the seeds you buy

are packed and sealed in the original package/bag with an original certificate from the producer of the seeds.

Sometimes, smallholder oil palm farmers collect germinated seeds from old *Tenera* trees or from trees in the wild (*Dura*), and grow these seeds in a nursery to be planted later on the palm farm. These farmers think that those seeds will produce a high yield in the future, similar as from the trees that they came from. Unfortunately, this is not true. These collected seeds do not have the same yield potential as the mother tree and often will develop in to very low yielding, poorly developed trees.

You should not collect germinated seeds from under old palm trees because it will not do you any good. It will only be a waste of your time, your money, your labor and other resources.

For your nursery only use real certified pre germinated seeds from a trustworthy supplier.

**Most important key points to remember:**

1. Improved *Tenera* seeds look the same as wild *Dura* seeds. Be sure your seeds are real, certified *Tenera* seeds.
2. Buy only from a seed provider that people recommend and that can be trusted.
3. When your supplier brings the seeds, the seeds should be in a sealed, authentic bag and should have an original certificate from the producer.
4. Order your seeds well in advance. It can take 2-4 weeks before delivery takes place. Make sure you are ready to plant the seeds immediately after the supplier delivers the certified seeds.
5. DO NOT collect seeds from your own old trees or from trees in the wild. They will NOT produce well, even when collected from high yielding trees.
6. You should ONLY buy and plant certified germinated seeds

# 4.0 HOW TO CHOOSE A GOOD PLACE FOR YOUR NURSERY

You should find a good place for your oil palm nursery. It makes a big difference on how well your seedlings will grow. You should think about the following issues when selecting a place where you want to start the nursery. It is very important to think about the number of seedlings you want to grow in the nursery. A small number of trees only need a small nursery area and less potting soil. This might be easier to find. You will spend most of your time with watering the plants. To have the nursery near a water source that does not dry up, but that also does not flood after heavy rains, is very important. For a good place to start a nursery you should consider the following points:

1. Choose a site that is flat but where rain water does not puddle. You don't want to waterlog your plants.
2. Select a site near a clean water source. For example near a stream, creek or a river that runs throughout the year and that does not dry up so that you can water your seedlings throughout the nursery period. You should make sure that the place does not flood from a lot of water in the stream or river during the heavy rains.
3. You should select an area that is not shaded out by other crops, forest or shade trees.
4. You should find a place that has plenty of good top soil (loamy soil) where you can fill your nursery bags at least two times.
5. Select a site that can be easily secured against theft, vandalism, (wild) animals and pests. Sometimes a small place very near to your house might be the safest place and the easiest to keep safe.
6. You should find a site for your nursery that is not too far from the field where the mature seedlings will be planted.

## **Most important key points to remember:**

1. Choose a flat area where water does not puddle;
2. Find a place near a good water source that does not flood during or after heavy rainfall;
3. Find a place that is near enough top soil to fill your plastic bags in which the palm seeds will grow;
4. Select a place that you can make safe against theft, animals and pests, and
5. Not too far away from the palm farm where the seedlings will be planted finally.

# 5.0 SETTING UP THE NURSERY

Before you set up a nursery, you need to have the necessary tools to enable you set-up and manage the nursery properly. Some of the basic tools and materials that are needed include cutlass, hoe, shovel, digger (pick ax), wheelbarrow, watering can, small nursery poly bag (38cm x 45cm or 15" x 18") and large nursery poly bag (15cm x 23 cm (6" x 9"). You should order the poly bags a few in advance so that there is enough time to fill the bags before the pre-germinated certified seeds arrive.

To set up the nursery, you need to do the following:

- A. **Brush and clear** your nursery site by removing all tree, stumps, logs and debris from the place where you will start the nursery.
- B. **Find the good soil** in a place near the brushed site to dig loamy soil to fill your poly bags for the germinated seeds.
- C. **Dig up the soil** that you will use to fill the poly bags for the germinated seeds.

- **DO NOT USE SANDY OR CLAY SOILS TO FILL YOUR NURSERY BAGS.**
- **YOUR SOIL TO FILL THE POLY BAGS HAS TO BE A FINE LOAMY SOIL.**
- **REMOVE ALL SIZES OF PEBBLES AND ROCKS.**

- D. **Clean and improve the soil quality** before you fill the poly bags. Clean the soil of diseases by gathering dry grass, leaves or any dry materials over the soil and burn it to kill any soil borne diseases that may affect the young germinated seeds. Mix the ashes with the soil to increase the pH level since Liberian soils are mostly acidic due to high rain fall. If you can get dried goat or cow manure, use it to mix with the soil. The seedlings will really like that and will grow very well.

- E. **Turn the bags inside-out.**  
When filling the nursery bag, the bags should be turned inside out before filling so that they sit upright. Also, ensure that you do not fill the bag with large stones, roots and other debris in the bag.

- F. **Use dry or light moist soil.** It is essential to ensure that the



**Picture 2**

The small poly bags for the pre-nursery are being filled with good soil.

(Photo by Marvelous Queejay-Weah ACIDI/VOCA)

soil is not wet when you put it in the bag. Wet soil can later compact to a solid clod which is not good for a good root growth.

- G. **Use wooden frames.** The filled bags should be arranged in a wooden frames to prevent from toppling over.



**Picture 3**

An oil palm nursery with wooden supports to keep the poly bags together in the beds. The nursery is fenced with bamboo and covered with palm thatch to shade the seedlings. This nursery has about 600 seedlings..

(Photo by Marvelous Queejay-Weah  
ACDI/VOCA)

- H. **Build a shelter** using local materials such as round poles, bamboos, and palm fronds/thatches. The shelter should be covered with palm fronds/thatches to provide initial shade for the germinated seeds.
- I. **Fence the nursery site** against roaming animals (pigs, goats/cattle's, etc), and intruders or unauthorized persons.



**Picture 4**

An oil palm nursery protected by a fence to keep unwanted "visitors". The nursery has a thatched roof to shade the young oil palm seedlings.

(Photo by Marvelous Queejay-Weah  
ACDI/VOCA)

- J. **Be ready** before the certified pre-germinated seeds arrive. Make sure that the nursery is ready (poly pots filled, fenced nursery ready, thatched roof ready and labor available planting in the poly pots and for watering) before the germinated seeds are received or arrived from where they have been ordered. It is the best if you have all poly bags filled 1-2 weeks before the seeds arrive.

- K. **Pot pre-germinated seeds immediately.** When you receive your ordered pre-germinated certified seeds you should pot these seeds within one day. **If for any reasons the sowing is delayed, the pre-germinated seeds must be stored in a cool place to reduce the rate of root elongation.**

**Most important key points to remember:**

1. Brush and clear;
2. Find the good soil;
3. Dig up the soil;
4. Clean and improve the soil quality;
5. Turn the bags inside-out;
6. Use dry or light moist soil;
7. Use wooden frames;
8. Build a shelter;
9. Fence the nursery site;
10. Be ready, and
11. Pot pre-germinated seeds immediately after you have received them.

# 6.0 THE DIFFERENT WAYS YOU CAN RAISE YOUR SEEDLINGS IN A NURSERY

There are two types of nursery: One is called the single stage nursery and the other one is called the double stage nursery.

In a **single stage nursery** you will plant the certified pre-germinated seeds **direct into large poly-bags**. This means that when the large poly-bag is filled with the black top soil, the certified pre-germinated seed is placed in the large poly-bag. The seed stays in the large poly-bag until it reaches the time of transplanting. The single nursery procedure is mostly used when there are few germinated seeds because it is cheaper.

In a **double nursery** you grow the seedlings in two steps. The first step is to grow the certified pre-germinated seeds in small poly-bags up to 3-4 leaf stage or 3 months after the germinated seeds are planted. After the first three months of taking proper care of the germinated seeds until it reaches 3-4 leaf stage, you then proceed to the second stage. This first step is also referred to as the **pre-nursery**.

The second step is when you transfer the 3-4 leaf plants into large poly-bags filled with black soil/loamy soil and place the seedlings in their big bag in an open space which is also referred to as the **main nursery**.

This guide will help you with the double nursery. The double nursery is a good way of taking care of a few hundred seedlings that are managed by a group of farmers. If you plan to grow only a few seedlings on your own, you should use the single nursery method because it will save you money (you don't need to buy small poly-bags) and the transplanting labor when you take the seedling out of the small poly bag to plant in a larger poly bag.

## **Most important key points to remember:**

For **small nurseries** (less than 50 pots/plants) you should use the one step nursery and plant the seeds in the large poly bag

For **large nurseries** (more than 50 pots/plants) you should plant the pre-germinated seeds in a small poly bag. When the seedling has 3-4 leaves you should transplant the seedling in a larger poly-bag.

# 7.0 PLANTING YOUR PRE-GERMINATED SEEDS IN THE POLY BAG

After you have filled the small poly bags with top loamy soil, water it one day prior to the planting of the germinated seeds, but **DO NOT** soak it for it to be watery.

When you receive the certified pre-germinated seeds from your supplier keep the seeds in the shade. When the seed bag has been opened, maintain moist seeds by sprinkling them with clean water from a well. **DO NOT** keep your seeds for a long time. Start planting the seeds the same day or the next day in the poly bag pots.

Planting is the easiest when you work in a team of two. The ‘seed handler’ (the person that takes the seeds out of the bag) places the seed on the soil (which is about two fingers below the top of the bag) with the root pointing downwards.

The ‘planter’ positions the seed correctly so that the shoot tip is about one finger below the surface after covering the seed with soil. The ‘planter’ gently stamps and levels the added soil with the palm of his/her hand.

**You should not bury the germinated seed deep into the soil, because the young plant will not grow well.**

Water your seedlings immediately after you have finished planting.

You must provide shade in the first 6 weeks. Full sun light can damage the plant and “burn” them. You can use palm fond on palm thatch to shade the young plants.



**Picture 5**

Filled poly bags ready to be planted with certified pre-germinated oil palm seeds

(Photo by Marvelous Queejay-Weah ACDI/VOCA)

**Most important key points to remember:**

1. Have your **poly bags filled** with good soil before the pre-germinated seeds arrive.
2. **Water your filled poly bags** the day before the seeds arrive
3. When the pre-germinated seeds arrive, **plant the seeds immediately** in the prepared poly bags. When planting is delayed, store the seeds in the shade to keep them cool.
4. **Plant** the seeds with the root pointing **DOWN** and the shoot pointing **UP**.
5. **Cover** the shoot with one finger of soil. Compact the soil lightly with your hand.
6. **Water** the seeds in the poly bags when you are done.
7. Make a roof of palm fond to shade the young plants.

# 8.0 MANAGING YOUR PRE-NURSERY

After planting your certified seeds in the poly bags, and putting them in a fenced off area with a shade roof, you should attend your nursery very other day. Looking after the plants every other day is very important. The time you spend depends on the number of seedlings you are raising.

**Watering.** You should water your young seedlings on a regular basis, especially when it does not rain every day.

When it has not rained for two days, water the seeds twice a day (morning and evening). See if the trees are doing well and do not show signs of water stress (brown edges of the leaves). Lack of water will damage the plants and will result in poor development of the trees. It can make the trees vulnerable for diseases and attack by termites.

**Less shade.** You have to start removing some palm thatch after 6-8 weeks. After two months of growth in the pre-nursery stage, remove some of the palm thatches to reduce the shade, so as to expose the seedlings gradually to the sunlight to begin the process of “hardening” the seedlings.

**Weeding.** You should remove all weeds two times in a week. Make sure that weeds are removed from the nursery. Keep the nursery clean of weeds. Weeds compete with the seedlings for water and plant food. Weeds can also provide shelter for diseases and pests.

**Get ready for the next step.** During the third month (after 80 days) when your seedlings have 3 or 4 leaves, you should begin filling the large poly bags with loamy top soil for your next step, the main nursery.

**Remove all the shade thatch.** In the two last weeks of the three months, you must remove every day some of the thatch that shades the seedlings in the pre-nursery to expose the seedlings everyday to more sun light.

**Apply manure or chemical fertilizers to your seedlings.** Giving manure or chemical fertilizers to your seedlings is very important. Seedlings need plant nutrients to grow and become strong.

## Most important key points to remember:

1. When it has not rained for a day you have to Water the seedlings.
2. Remove the shade a little bit every day after 6-8 weeks.
3. You must keep the nursery clean. No weeds!
4. Fill the large poly bags for the next step.
5. You should remove more shade every day so that the seedlings get used to full sun.

# 9.0 SOME ADVICE ON FERTILIZING YOUR PLANTS IN THE PRE NURSERY

**Mix TSP fertilizer with the potting soil.** When you fill the poly bags you can mix compost and manure (for example droppings from chicken, goat, and cow dung). You should start with TSP (Triple Super Phosphate). Later on you will have to use NPK (15: 15:15) or Urea.

**Continue with giving TSP.** This will help the root of the young plant to grow well. You should dissolve 1 ½ to 2 matchbox full of TSP in one gallon of water. You should use this one gallon of ‘fertilizer water’ for 100 plants. Give it to the plants in the morning at the base of the plant.

**Give NPK after the first leaves have developed.** When your seedlings have developed their first leaves you should give a little NPK (or Urea) fertilizer. This is about one month after planting the seed in the poly bag.

**Do not water after giving fertilizer.** After the application of the fertilizer, the seedling should not be watered on that day because the fertilizer will be washed away. You should not give fertilizer to the seedling when it looks like that it is going to rain otherwise the rain will wash the fertilizer out of the soil.

**You should give fertilizer once a week.** Do this until the seedling is ready to go to the main nursery. When you water the young seedlings, make sure that the fertilizer has well dissolved in the water so that no solid parts of fertilizer get on the leaves. Make sure you give the fertilizer that is in the water to the soil at the base of the plant. Avoid wetting the leaves to avoid burning or scorching.

**Most important key points to remember:**

1. Mix TSP fertilizer with the potting soil
2. Give more TSP fertilizer in the first 30 days
3. Mix the TSP into water and pour a little at the base of each plant
4. Do not water after giving the fertilizer and water mix
5. Do not let water and fertilizer touch the leaves
6. Give small amount of fertilizer every week

# 10.0 HOW TO START YOUR MAIN NURSERY

After you have been taking care of the young seedlings for about three months in the pre-nursery it is time to transplant your seedlings from the pre-nursery to your main nursery.

**Be ready.** Make sure that you have the right number of large poly bags filled with good soil. You should mix the soil with manure and compost if you can find it. Your seedlings will grow much better!!

Place the large poly bags on the main nursery field. Space them 1 meter (1 large step) from each other in the row and between rows. Be sure you have space enough to move around the plants when the seedlings have grown in a few months. When you place the seedlings in a straight line it will be easier to spot for weeds.

**Move your seedlings.** You will have to move your seedlings from your pre-nursery to the main nursery when the seedlings show 3 or 4 leaves, and are about 3 months or 90 days old.

**Water!** You should water the large poly bags in the main nursery one day before transplanting to facilitate the digging of a hole in the middle of the large poly bag for the pre-nursery seedling to be transplanted.

**Dig a hole** in the center of the large poly bag filled with good soil. You should use a spoon like tool or simply use your hands. The hole must be large enough to place the small poly bag in the newly dug hole.

**Bring your pre-nursery seedlings to your main nursery.** Carry the small poly bags seedlings from the pre-nursery to the main nursery and place one seedling beside each large poly bag.

**Cut the small poly bag.** You should cut the small poly bag open by making a bottom to top slit along the side of the bag. Use a razor blade or a sharp knife.

**Plant the seedling in the new, large poly bag.** Remove the small poly bag and plant the seedling with the soil from the small bag still on it into the large poly bag. Plant the seedlings in such a way that the surface of the soil from the small poly bag is flush with the surface of the soil in the large poly bag. Make sure that in the end the soil of the large poly bag is slightly below the top edge of the big poly bag so that the available space can be used for mulching.



**Picture 6**

Young oil palm seedlings in the main nursery

(Photo by Marvelous Queejay-Weah ACDI/VOCA)

**Water!** After you have transplanted all your seedlings, you must water the seedlings the same day. This is good for the root development of the young seedling.

# 11.0 TAKING CARE OF YOUR SEEDLINGS IN THE MAIN NURSERY

To protect your seedlings against drying out, you should mulch your seedlings after transplanting them into the large poly bags for the main nursery. Place a layer of mulch in each large poly bag. You can use dried grass or dried palm chaff.

You should spread the mulch in a thin layer evenly over the soil surface but leaving bare the area immediately around the collar of the seedling (about a thumb length from the collar).

You must give NPK (15-15-15) fertilizer two weeks after transplanting the seedlings into the large poly bags. You can mix the fertilizer with water or you can give each plant a few pellets of fertilizer. You can also make Liquid Manure from cow dung and goat manure. Ask your extension agent for a PROSPER Liquid Manure pamphlet explaining how to do that.

When you mix chemical fertilizer with water, you must mix 20 grams (3- 4 match boxes) with four liter of water for 25 seedlings.

When you give the fertilizer in pellets, put the pellets under the mulch on the surface of the soil leaving two fingers away from the plant and water daily. The pellets will dissolve gradually into the soil for your plants.

You should weed every week to ensure that the nursery is completely free of weeds. Weeding should be done by hand. Weeds can be a host for diseases and pests so get rid of them.

If pest and diseases are not detected and controlled in time when there is an outbreak.

## **Watch your trees!!!**

Walk at least once a week through your rows of oil palm seedlings and see if there are any signs of diseases or pests that attack your plants. Early discovery will give you time to do something about the pest or disease. If you wait too long, or do not see it in time, you may lose many of your seedlings

Your trees can be attacked by cane rat (grass cutter or ground hog in Liberia), rats, porcupine (hedge hog), and live stocks you or your neighbors keep, like sheep or goats. It is very important to check and inspect your fence everyday to make sure that no animal can get through the fence of your nursery.

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