Characteristics of organic food for Tilapia fish

Date 10/03/22

Topic: Aquarium fish ✓

Topic: Farmed fish ✓

Form	Flakes	Lyophilized	Pellets	Granules
Colors	Artificial Red,green and yellow	Preserves the color of natural food	Preserves the color of natural food	Preserves the color of natural food
Size	Alevin: 0,5- 1.5 mm Juvenile: 1.5-2 mm Adult: 3-4 mm	Alevin: 0,5 - 1.5 mm Juvenile: 1.5-2 mm Adult: 3-4 mm	Alevin young: 0.2-1 mm (dust) Alevin : 1 - 1.5 mm(crumb) Juvenile: 1.5-2 mm Adult: 3-4 mm	Adult
Organoleptic characteristic	Artificial	Preserves taste and smell of natural food	oil coating	oil coating
Nutritional requirements				

Stage of development	Concentrated protein %	Lipids %
Alevin	>35	8
Juvenile	>25	5
Adult	>30	5

Unidentified

Species selection 14/03/2022-Joselyn Ipiales

Insects

Hermetia illucens

Nutritional value ✓

Hermetia illucens fly larvae process organic waste by recycling the nutrients into high-value insect protein.

This insect protein can be marketed as animal feed, in addition to generating organic waste suitable for agricultural repairs

The larvae represent an excellent food source for many types of animals such as fish, birds, reptiles, amphibians and others.

Its high protein concentration and other nutrients such as; fatty acids, pigments, vitamins or minerals, allow their inclusion in diets in poultry, livestock and aquaculture.

Characteristics ✓

The larvae can grow rapidly and have excellent feeding speed.

Larvae can consume 25 to 500 mg of fresh matter/ larva/day and feed on a wide range of substrates ranging from manure to food waste.

The larvae of H. illucens have similar contents of protein and fat to fishmeal, being feasible their use for fish feed

H. illucens larvae can provide foods rich in protein (40 to 44%) with a better amino acid profile.

Location ✓

Native to the tropical, sub-tropical and temperate regions of America, it is currently found throughout the rest of the world, between 40° south latitude and 45° north latitude, being found in many countries in Europe, Africa, Oceania (Australia and New Zealand) and Asia (Indonesia, Philippines, Japan and Sri Lanka)

Insects

Tenebrio molitor

Nutritional value ✓

It is considered as live food, because during its larval stage they are used as food for various organisms, because they contain 53% protein in dry weight.

The tenebrio molitor is a clean and odorless larva and due to its feeding and production method it cannot be a carrier of Salmonella, Tuberculosis, Toxoplasmosis, among other things, as traditional animal protein sources could be.

	Proteína %	Grasa %	Sales minerales %	Fibra %	Carbohidratos %
LARVA	53.13	36.65	3.19	5.10	1.90
PUPA	47.76	38.29	2.77	6.91	4.24

Characteristics ✓

The larvae like the dark and to be attached to some object. They undergo up to 15 molts, until their skin is not large enough to contain their viscera.

Tenebrio molitor contributes greatly to a more natural diet. Because of its protein content.

Tenebrio molitor can also feed on different products, both of plant and animal origin: bread, biscuits, decomposing tree bark, meat scraps, hides, etc.

location

The larvae measure around 2.5 cm, or even more, while the adults do not usually reach 2 cm in length.

In the wild, mealworms are found between stones and trunks or in grain stores, being a pest for grain production. As decomposers they can feed on dead insects or feces, apart from plants, seeds and fallen leaves.

Species selection-14/03/22-Francis Ariel

Microalgae

Spirulina maxima

Spirulina is used as a substitute for fishmeal or as a functional supplement to improve the growth and health of fish.

Spirulina-fed fish have less abdominal fat, better taste, firmer flesh, shinier skin and show better development.

Significantly increases pigmentation in fish and also stress tolerance.

Spirulina is marketed in powder or tablet form.

Reference
https://doi.org/10.1111/raq.12439
https://doi.org/10.1046/j.1365-2109.1998.29100709.x

Nutritional content

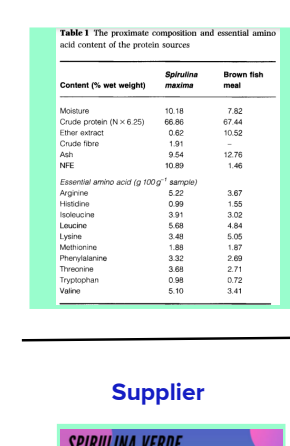
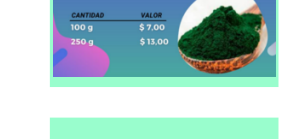


Table 1 The proximate composition and essential amino acid content of the protein sources

Content (% wet weight)	*Spirulina maxima*	Brown fish meal
Moisture	10.18	7.82
Crude protein (N × 6.25)	66.86	67.44
Ether extract	0.62	10.52
Crude fibre	1.91	–
Ash	9.54	12.76
NFE	10.89	1.46
Essential amino acid (g 100g⁻¹ sample)		
Arginine	5.22	3.67
Histidine	0.99	1.55
Isoleucine	3.91	3.02
Leucine	5.68	4.84
Lysine	3.48	5.05
Methionine	1.88	1.87
Phenylalanine	3.32	2.69
Threonine	3.68	2.71
Tryptophan	0.98	0.72
Valine	5.10	3.41

Other features

Supplier



Store: Organic world keto
Location: Ecuador-Pichincha
Shipping: only nationwide
Page of Fb: https://www.facebook.com/OWKETO

Nutritional content

Contein	Concentración %
Fat derivatives	30.6%
Soluble carbohydrates	48.20
Protein	30.45
High crude fibre content	8.93%

Location

America and Africa

Are used as a powder in flour, the leaves after cooking are soft

Plant

Moringa oleífera

The leaves, which are very rich in protein, beta-carotene, thiamine, riboflavin and other vitamins, can be made into flour.

High protein level, good ingredient for fish feed preparation.

It has been tested in several fish species as a possible substitute for soybean meal.

Stimulates the growth of the fish and also the colour they acquire.

Reference
http://www.repositorio.usac.edu.gt/id/eprint/10441
http://hdl.handle.net/11036/6416

Species selection-14/03/22- Jimmy Guerrero

Fungi

Fusarium venenatum

Source of protein and fiber.

Umami flavour.

Low fat content. May function as a prebiotic in the lower gut

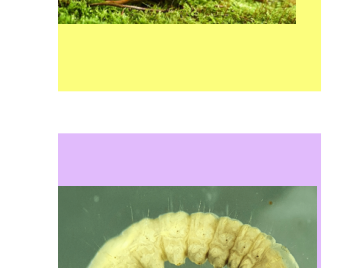
Could be benefit in the dietary treatment of diabetes.

location

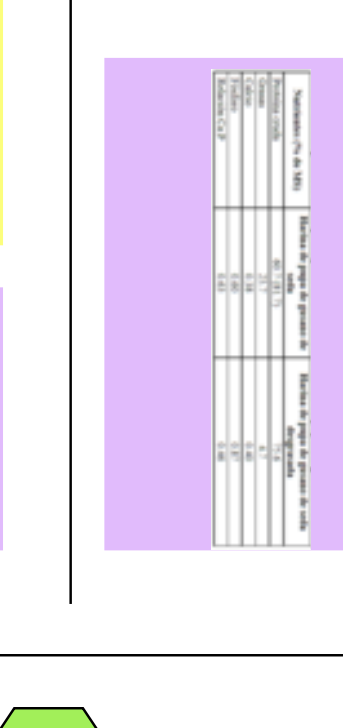
Worldwide

Worldwide

pictures



nutritional contents



Insects

Galleria mellonela

is a larva that feeds on beeswax and honey.

is as rich in fat as it is in protein

Silkworm pupa meal has a crude protein (CP) range of 52-72 %.

Silkworm pupae contain18 known amino acids.

Species selection 14/03/2022- Cindy Rodríguez

Microalgae

Chlorella vulgaris

Useful as live food for optimal fish diet, it can help improve the quality of fish growth.

The meal from these microalgae is a renewable product produced under controlled conditions, which contributes to sustainable aquaculture.

It has unique and interesting biochemical properties as a food supplement for fish.

In its natural state, Chlorella vulgaris is a spherical, green, refringent cell.

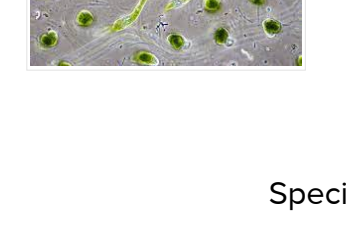
Nutritional content

It has a high content of proteins (45-60%), fats (20%), carbohydrates (20%), minerals, salts and vitamins (15%). It is also rich in calcium, magnesium, iron and has a high content of chlorophyll, carotenoids and different vitamins (B1, B2, B6, B12, C and E).

Taxonomy

Location

It inhabits rivers, freshwater streams and swampy soils.



General information

Insects

Musca domestica

Musca domestica larvae meal has a protein composition of up to 56.7%, which makes it an

Is one of the insects that has a great potential to be used in animal feed, since it has a short life

Flies larvae meal has been included as a supplement in fish diets with generally positive

The musca domestica provides a certain amount of nutrients in larval or adult stage, the larvae have a high content of crude protein (40 to 60%) and lipid content (9 to 25%).

Nutritional content

It has a high percentage of protein (56.6%), calcium (0.27%), phosphorus (1.08%) and carbohydrates (4.89%).

Taxonomy

Location

Worldwide

Characteristics of the Musca Domestica

Characteristic	Description
Color	Opaque gray
Length	6 – 9 mm
N° antennae	2 small
N° legs	3 pairs
Mouthparts function	Lickers or suckers

General information

Species selection 14-'3-2022. By: Omar Vargas

Insect - Acheta domestica

Product to be obtained:

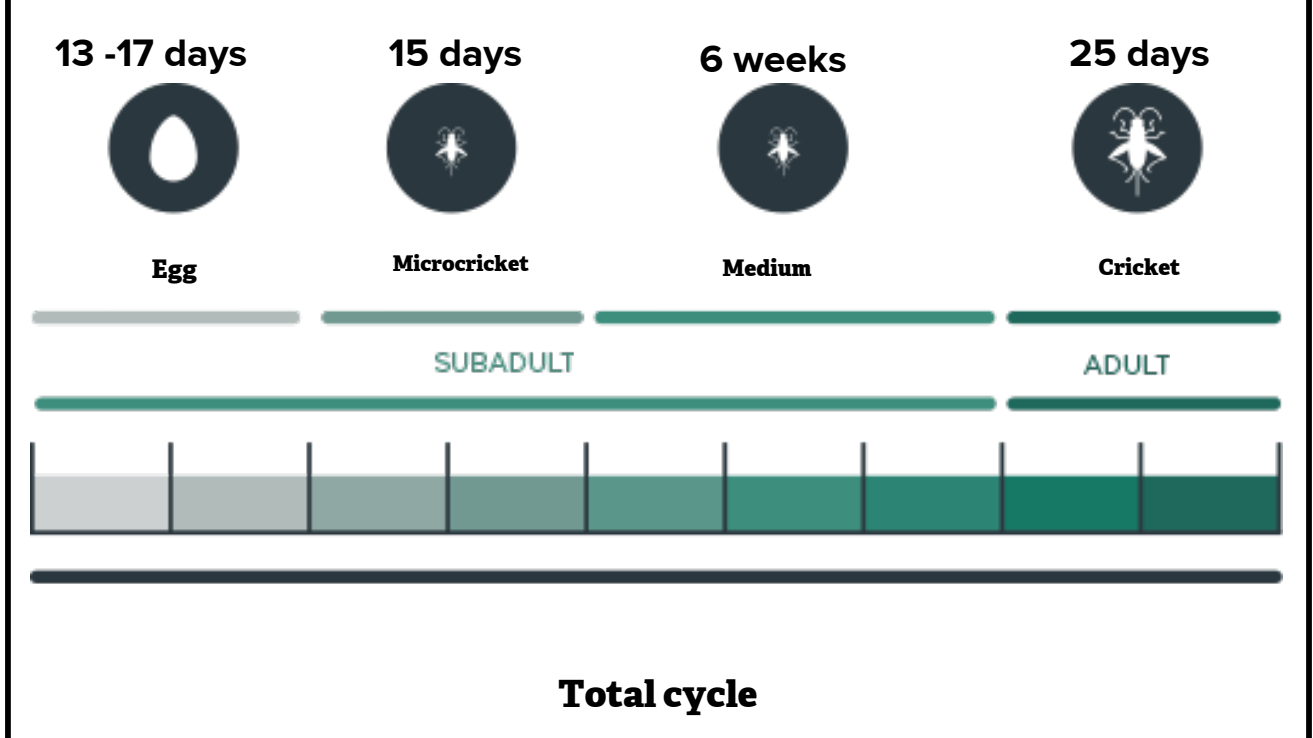
%	Nutritional content
62.00	Crude protein
7.00	Crude fiber
5.20	Liquid
0.99	Phosphorus
1.28	Potassium
0.19	Calcium
0.11	Magnesium

-Replaces the fish meal

-Its raw protein content is higher than meat products

Location:
- worldwide

Life cycle of Acheta domesticus



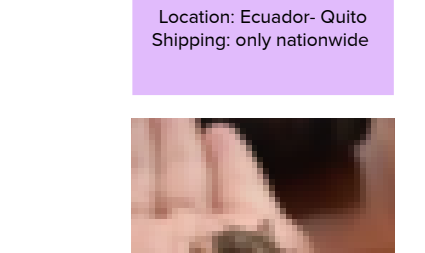
Selection of the specie to be analyzed

15/03/2022

Suppliers of Acheta domesticus

Local

Store: Mercado libre
Location: Ecuador- Quito
Shipping: only nationwide



20 adult specimens for $2.50
150 microcrickets for $2.50

Delivery by servientrega

Local

Store: SARgrillo
Location: Quito-Ecuador
Shipping: only nationwide
Page: https://sargrillo.negocio.site/

100 units for $ 10,00
300 units for $ 25,00
1000 units for $ 65,00
Delivery by servientrega for a cost of + $ 5.00

In the form of medium-sized crickets

Suppliers of Tenebrio molitor

Local

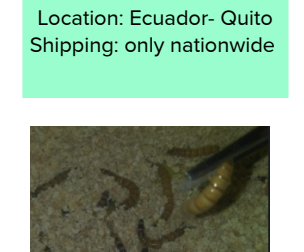
Store: Organic world keto
Location: Ecuador-Pichincha
Shipping: only nationwide
Page: https://atlantisacuario.com

40 units for $ 5,00
Delivery by servientrega for a cost of + $ 0,25

In the form of larvae

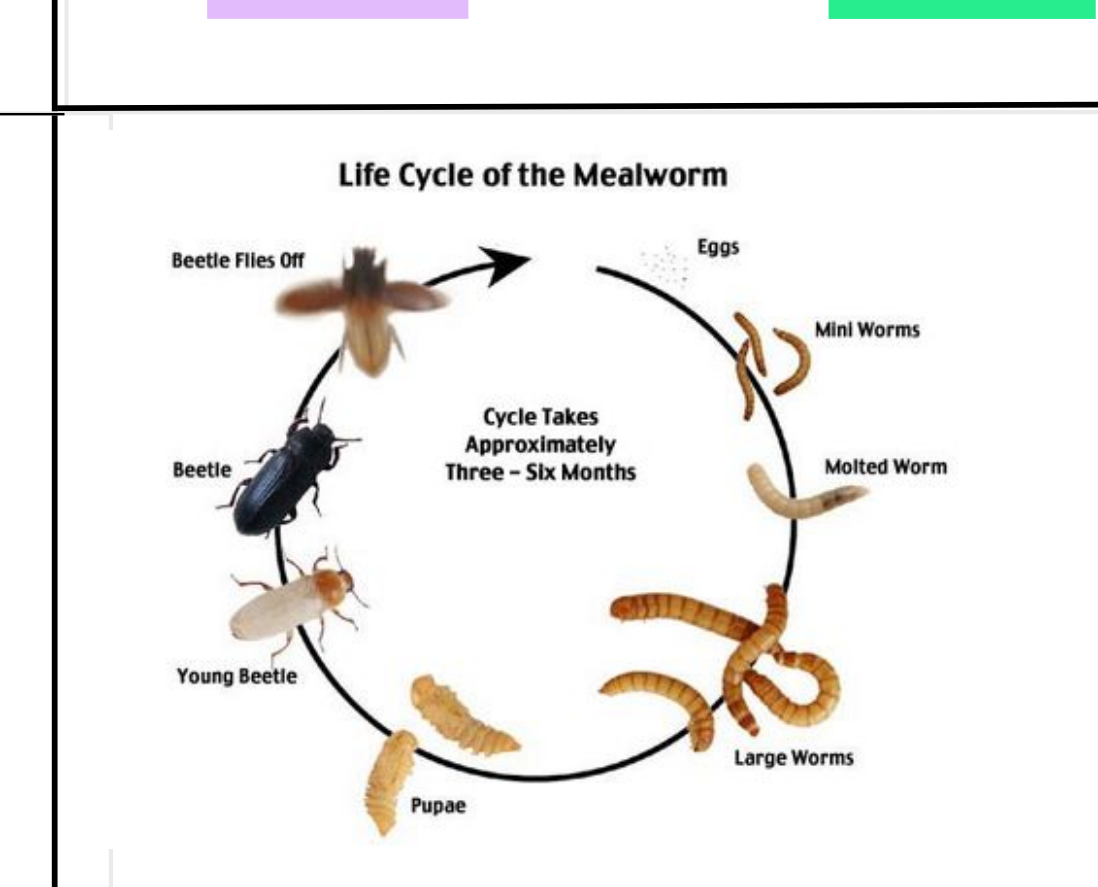
Local

Store: Mercado libre
Location: Ecuador- Quito
Shipping: only nationwide



30 units for $ 4,00
Delivery by servientrega

In the form of larvae



Questions:

One of the suppliers mentioned to us that he sold us adult male crickets without wings so that they would not sing, because it is not allowed in transport. would it be ok to get them like this or must they necessarily have wings?

16/03/2022

Insect Farm Design-21/03/2022

What is needed to set up an insect farm? → Acheta domesticus

What material is needed?	Do you need care?	At what stage should they be purchased?	What temperature they need?	Humidity	Substrate
Cardboard or plastic can be used	Drinking and feeding troughs will be placed. In order not to constantly interrupt the habitat and thus avoid stress.	Buy them at the adult stage to start the reproduction process as soon as possible.	Optimal temperature for reproduction is 27°C.	If there is no humidity the eggs will not hatch and in excess humidity fungi will grow on the eggs and they will not hatch.	The function of the substrate is similar to the environment in which they live.
You can start the reproduction cycle with 14 females and 6 males, the size of the box can be 40cmx40cmx70cm (a maximum of 400 specimens), although the size varies depending on the amount of insects needed.	In order not to constantly interrupt the habitat and thus avoid stress.	Buy males and females	The optimum temperature for incubation is 29°C.	Moisten the environment with non-chlorinated mineral water.	It can be a base made of small pieces of cork.
If it is cardboard, it is necessary to cover it with a metal mesh to prevent the isect from breaking the cardboard.	Rigorous controls (1-2 times a day) will be made during the incubation phase, to control humidity and temperature.		The optimum temperature for crickets to develop is 25 to 32°C.	Water troughs can be placed at different points, thus maintaining humidity.	Another type of substrate can be soil without pesticides.
The cardboard lid should have 3 mm holes and a 3 cm hole on each side.	Controls will be made to avoid overpopulation.		The optimum temperature for incubation is 29°C.	A humid environment should be maintained at all times, with a relative humidity of 70%.	
Separate the eggs to be incubated in another growth box. Coat the box with a layer of plexiglas, and cover it with wet gauze. Once the eggs are grown, transfer them to the normal rearing box.	Every 5-6 months new crickets will be placed, to avoid genetic crossbreeding between relatives and in this way that there is genetic variation.		The optimum temperature for crickets to develop is 25 to 32°C.		

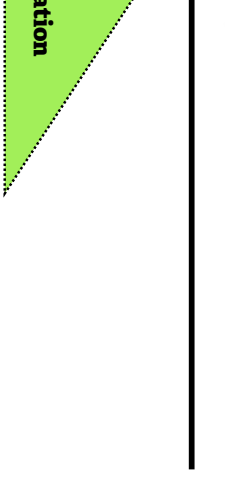
What is needed to set up an insect farm? → Tenebrio molitor

What material is needed?	Do you need care?	What kind of food do they need?	What temperature and humidity do they need?	Review periods
It is recommended to use a plastic tray	It is advisable to keep them in a dark area, they do not need lighting because they are photophobic.	The substrate used in the breeding of tenebrios must be composed mostly of cereals and derivatives rich in carbohydrates.	The optimum temperature is 24°C to 35°C. The higher the temperature, the better the reproduction.	Every week: you should change the piece of apple, potato, carrot or the fruit or vegetable that you have decided to leave to hydrate them. You should also check if fungi or bacteria have not been generated inside the container.
The dimensions for the tray must be: 40x40x20cm	Care must be taken to avoid excess humidity in order not to attract mites and fungi.	Wheat flour will be used as the primary feed, which should be changed every 15 days.	They require a good air humidity of around 75%.	Every month: you should check if beetles have been generated. If so, you'll need to start separating them and putting them in another container. For this, you can use a piece of apple to attract them.
The plastic tray will depend on the number of tenebrios you have.	Substrate can be wheat flour in a layer of 5 centimeters, which will be cleaned or changed every fifteen days.	In later stages they are fed with vegetables in good condition such as lettuce, carrots, corn, spinach.	They require a substrate humidity of about 40%.	Every semester: you must change your food and store it in another container for a month, since there may be hidden larvae that you can later add to your hatchery.

Form of reproduction → A few days after copulation, the female will lay about 300 eggs. → Should be incubated for 15 days. → Reproductive females need to be moved from one container to another to initiate the production of small tenebroids.

EE.UU

Cricket flour



1-lb
$39
$11 shipping

1-lb
$34.99
$11 shipping

1-lb
$38.95
$11 shipping

3-lb
$105.00
$20 shipping

Price Enquiry

300 dry crickets = 20$

1 kg crickets = 500$

Cricket fertiliser

It is made from ground crickets

Contains 51.8% protein

contact Sargrillo 099 502 9902

Experimental part-Final conclusion

25/03/2022

Quinoa

The seed is considered a pseudocereal due to its high carbohydrate content, mainly starch (50-60%), which makes it used as a cereal, and it also has a high fat and protein content.

If we put a glass of water and add quinoa in its normal state, the quinoa particles mostly go to the bottom and very few float on the surface for some time, then they consecutively go to the bottom.

When the quinoa is toasted it pops like corn, and then when water is added most of the grains begin to float.

When quinoa is toasted, it expels a certain amount of its fat content that surrounds the grain, so when water is added to it, due to its difference in density, it tends to have buoyancy.

Quinoa in its normal state
Toasted quinoa
Quinoa powder

Amaranth

Starch is the main component of amaranth seed, representing between 50 and 60% of its dry weight, it also has a high caloric and fiber content.

When water is added to a portion of amaranth grains in their normal state, they tend to float.

Once the amaranth grains are toasted, if a quantity of water is added, they tend to float on the surface.

Unroasted amaranth has a nutritional content similar to quinoa, it has a high percentage of buoyancy in water due to its high fat content.

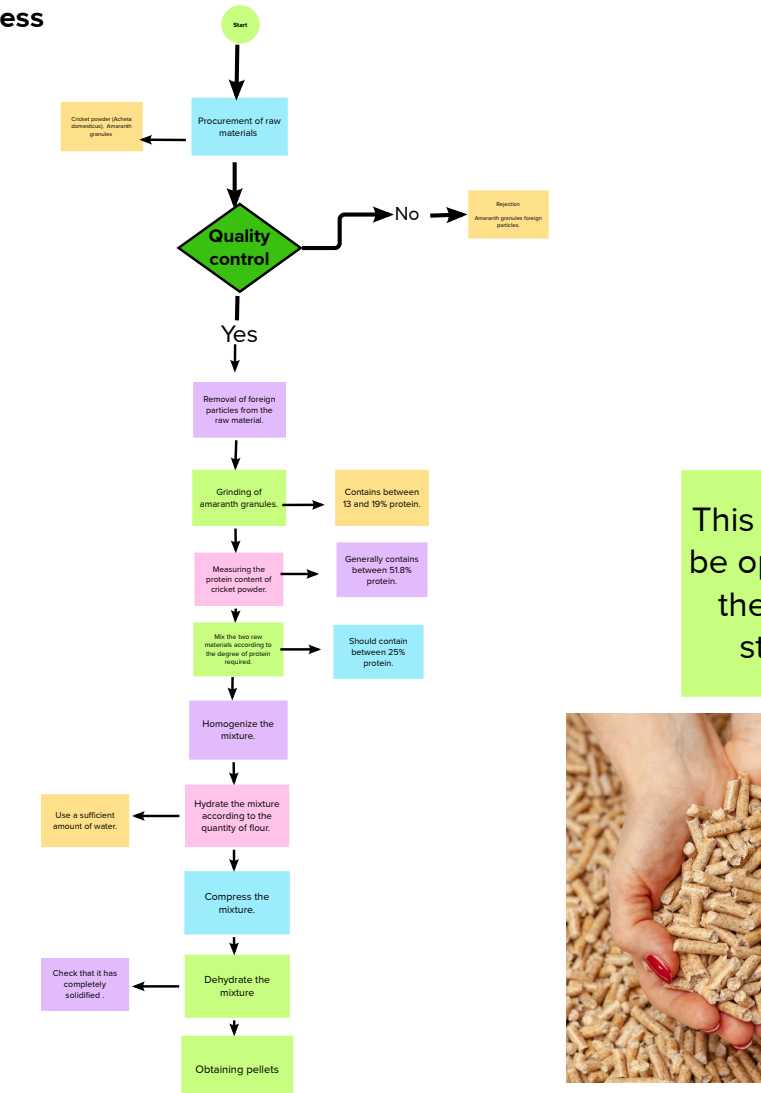
Amaranth in its normal state
Toasted amaranth
Amaranth powder

Amaranth meal coated fish feed manufacturing process

30/03/2022

Additional information

We chose amaranth to complement it with cricket flour because it has a high content of starch, protein and also has greater buoyancy, which would be useful for feeding the fish, they would be in the form of pellets with the appropriate size according to their weight from the fry to the adult stage.



Start → Procurement of raw materials (Cricket powder (Acheta domesticus), Amaranth granules) → Quality control → No → Rejection: Amaranth granules foreign particles.

Yes → Removal of foreign particles from the raw material. → Grinding of amaranth granules. (Contains between 13 and 19% protein.) → Measuring the protein content of cricket powder. (Generally contains between 51.8% protein.) → Mix the two raw materials according to the degree of protein required. (Should contain between 25% protein.) → Homogenize the mixture. → Hydrate the mixture according to the quantity of flour. (Use a sufficient amount of water.) → Compress the mixture. → Dehydrate the mixture (Check that it has completely solidified .) → Obtaining pellets

This food can be optimal for the Alevin stage.

30/03/2022

Questions:

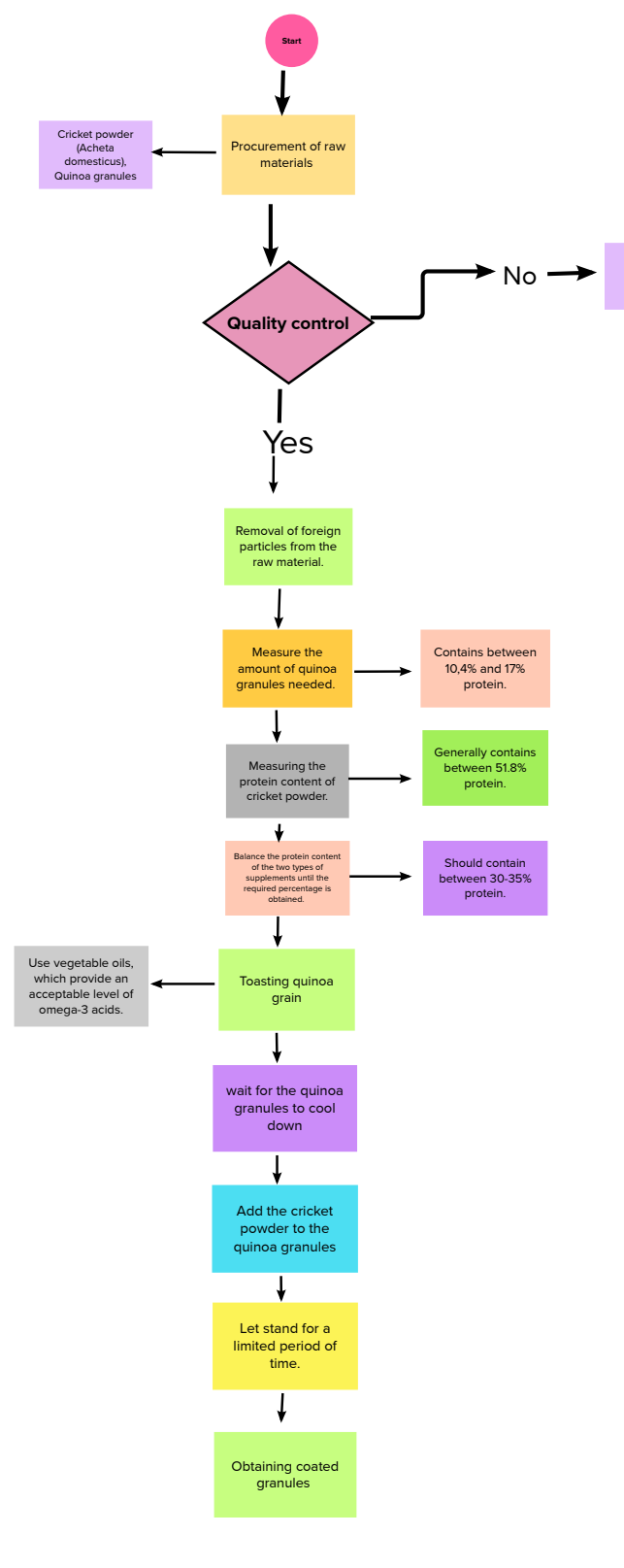
Hi, I had a question, can you substitute cricket meal for mealworms? Since you have indicated that mealworms are more cost effective in terms of price.

In the mealworm, what would be the species of mealworm, do you mean Tenebrio molitor or another species? To investigate in case it is another one.

Where we would do the test of the created food, would be in the farm that you indicated to us at the beginning.

Manufacturing process of quinoa grains coated with cricket meal as fish food

31/03/2022



Start → Procurement of raw materials (Cricket powder (Acheta domesticus), Quinoa granules) → Quality control → No → Rejection: Foreign particles of quinoa granules.

Yes → Removal of foreign particles from the raw material. → Measure the amount of quinoa granules needed. (Contains between 10,4% and 17% protein.) → Measuring the protein content of cricket powder. (Generally contains between 51.8% protein.) → Balance the protein content of the two types of supplements until the required percentage is obtained. (Should contain between 30-35% protein.) → Toasting quinoa grain (Use vegetable oils, which provide an acceptable level of omega-3 acids.) → wait for the quinoa granules to cool down → Add the cricket powder to the quinoa granules → Let stand for a limited period of time. → Obtaining coated granules

This food can be optimal for the juvenile and adult stage.

Experimentation to coat quinoa granules with cricket flour.

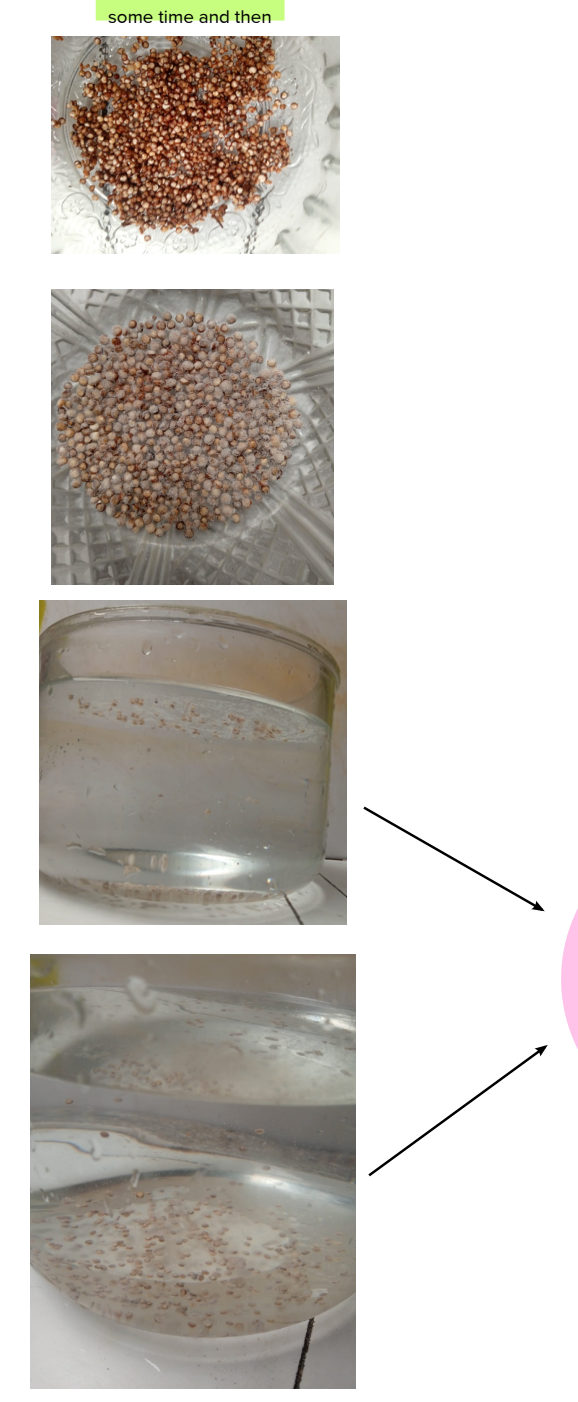
31/03/2022

The quinoa grain was toasted without oil and then coated with a little water, then flour was added but the texture obtained was granules stuck together in a single mass.

The dough was again toasted with oil and the quinoa grains separated but not completely.

It was tested for buoyancy in water and proved that it does float.

The quinoa grain was roasted with vegetable oil, allowed to cool for some time and then



Buoyancy was tested and shown to float for a limited period of time and then the granules sank.

Questions:

Hi, the question would be for which stage of the fish would the feed be for, as the fry only need powder, and the adults can already eat the quinoa sized particle, so for which stage of the fish growth would the feed be for?

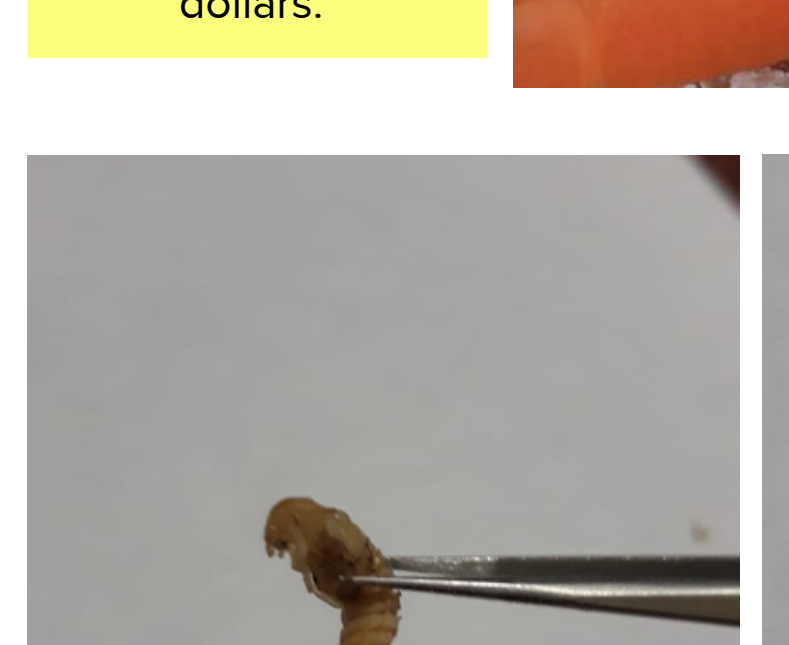
On what date should we start manufacturing the food? This is in order to be able to acquire the necessary material.

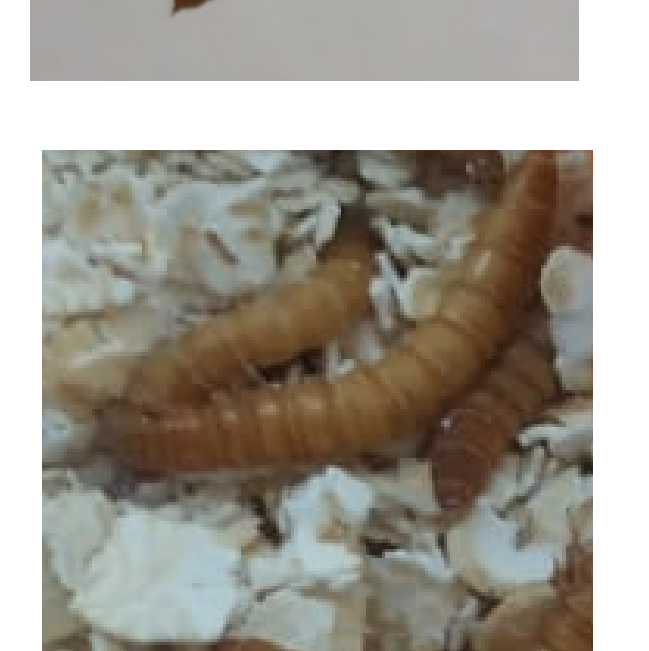
The small farm of Tenebrios molitor

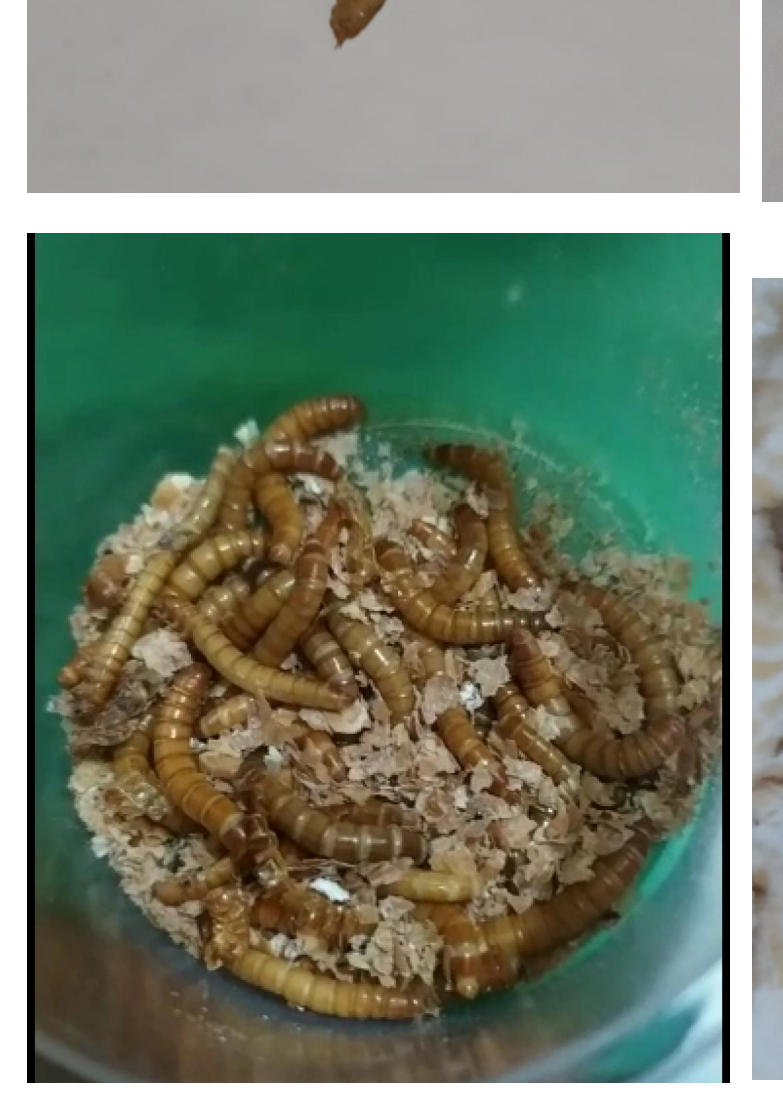
01/04/2022

We created a small breeding ground for tenebrios, and we have seen how they have been growing.

I buy them in Quito, in Atlantis Aquarium, the 35 larvae for 5 dollars.







We got these Molitor Tenebrios a couple of weeks ago, they have been taken care of according to what we have investigated, as time goes by they are changing stage, each time they are getting bigger and bigger and so far none of them have died.

Answers

1.- Would the powder stick better if the quinoa or amaranto is hot or cold?

2.- Will the powder stick like that without spraying water or oil?

3.- What is the solution for this? this happens of course. how to reparate again?

4.- What if you let it cool and not toast again, then break it in pieces?

Amaranth with wheat flour

The amaranth grains were roasted and wheat flour was added and then hydrated and dried in an oven, it was observed that the grain had a better adherence to the flour but it did not remain afloat in the water .

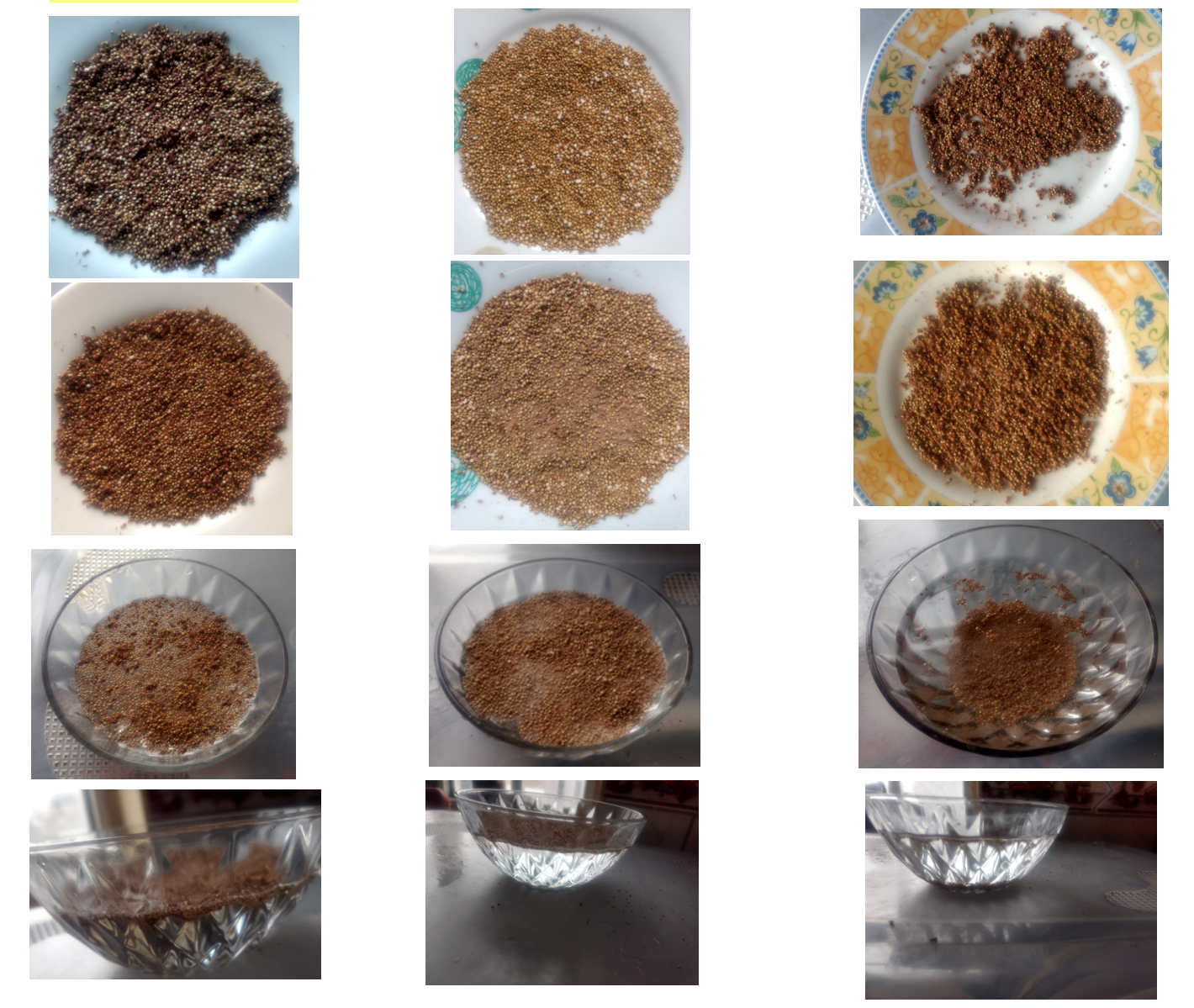
This is a title...

Amaranth coated with cocoa powder

Once the amaranth was hot roasted, the cocoa powder was added, a single mass was formed and when it was left to rest for a while, the grains began to separate, when checking the buoyancy all the grains floated to the surface.

After the amaranth was cooled for 30 minutes, the cocoa powder was added, but the bean was not coated, and its buoyancy was checked and it does float.

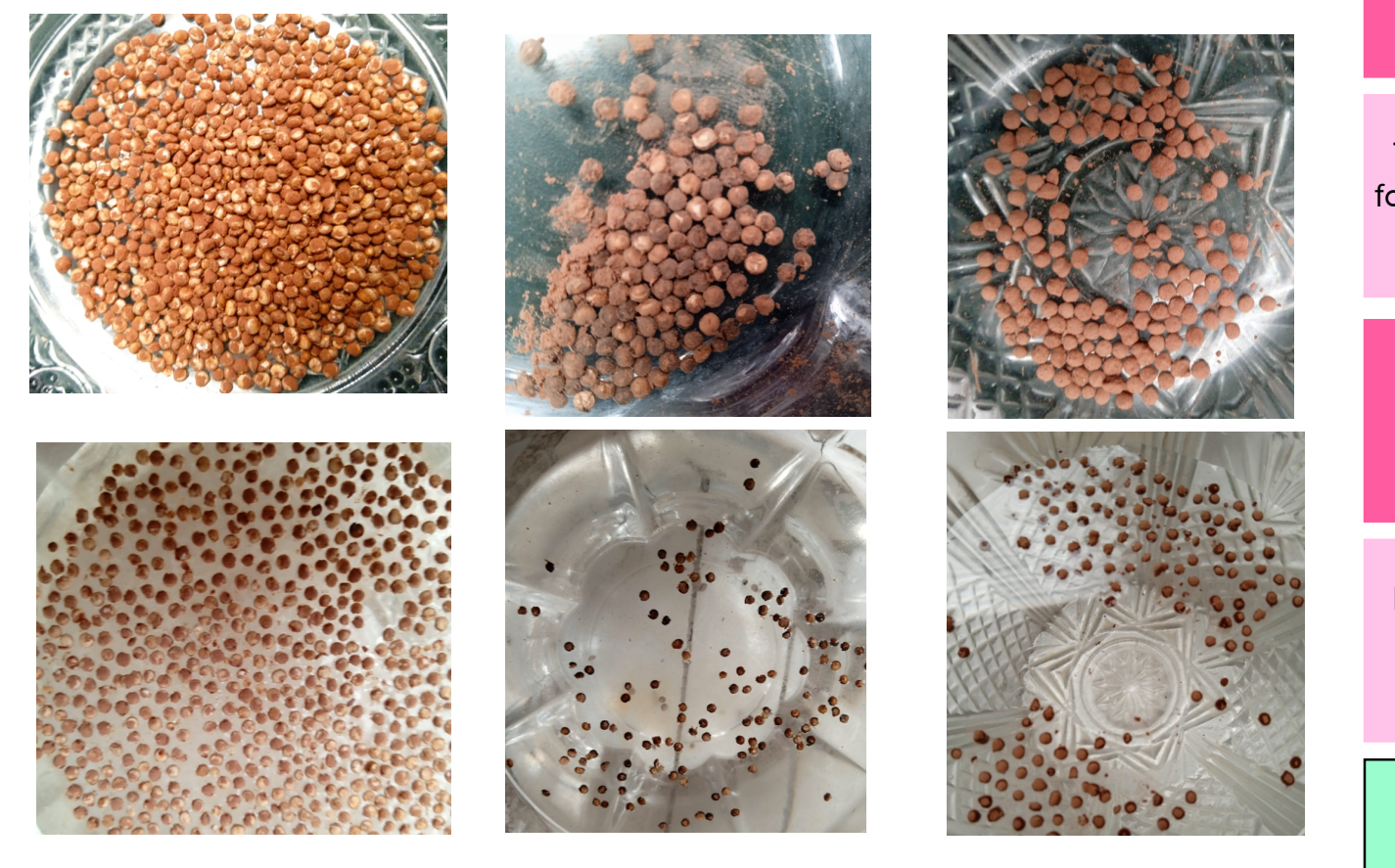
When the toasted amaranth grain was cold we added a little water and then the cocoa powder, a mass was formed and when we let it rest it began to separate by itself, when we checked the buoyancy it sank completely.



One of the best options for the grain to become coated with flour and have a higher percentage of buoyancy is when the roasted grain is still warm.

Quinoa coated with cacao powder

Experiment 1	Experiment 2	Experiment 3
Hot quinoa + cocoa powder	Cold quinoa + cocoa powder	Cold quinoa + whater + cocoa powder
The quinoa was toasted, and while it was still hot, it was mixed with the cocoa powder and found to have a very good adhesion.	The quinoa was roasted and allowed to cool, then mixed with the cocoa powder and found to have a not so good adhesion, however some powder did adhere to the grain.	The quinoa was toasted and allowed to cool, then briefly soaked in water and mixed with the cocoa powder and found to have excellent adhesion.
The float test was done and it floated without problem.	The float test was done and it floated without problem.	The flotation test was done and after 1:30 seconds, all the quinoa sank, so it does not have a good floating.



Conclusion

Floating

The best floating is found in experiment 1 and 2.

Adhesion

Experiment 1 and 3 have the best adhesion.

The best option is experiment 1

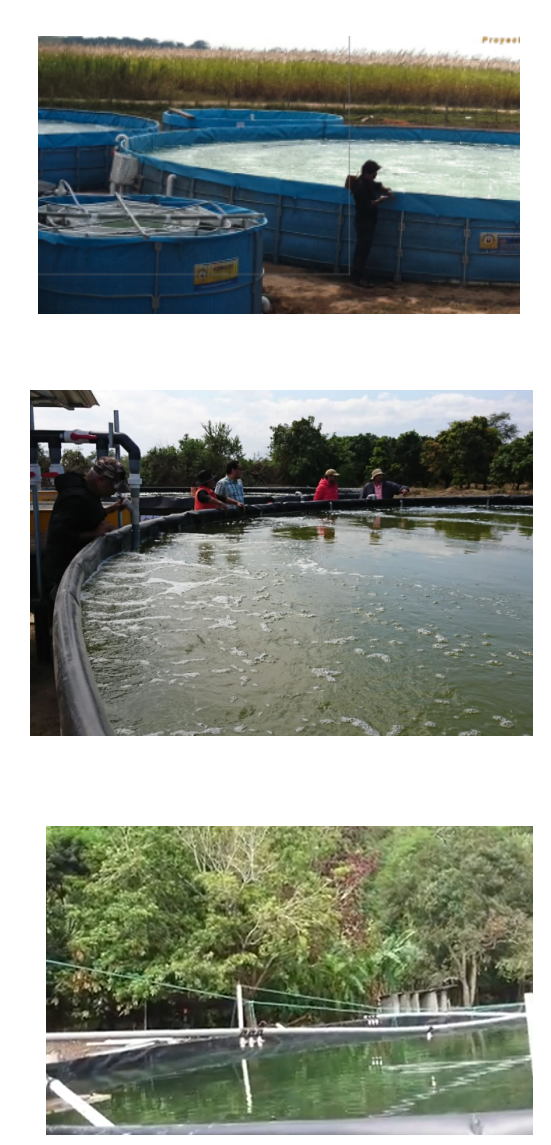
Fish Farms

04/04/2022

Lita-Imbabura Guadual

Señor de los Milagros- Quito Granja Agroecologica El Aliso

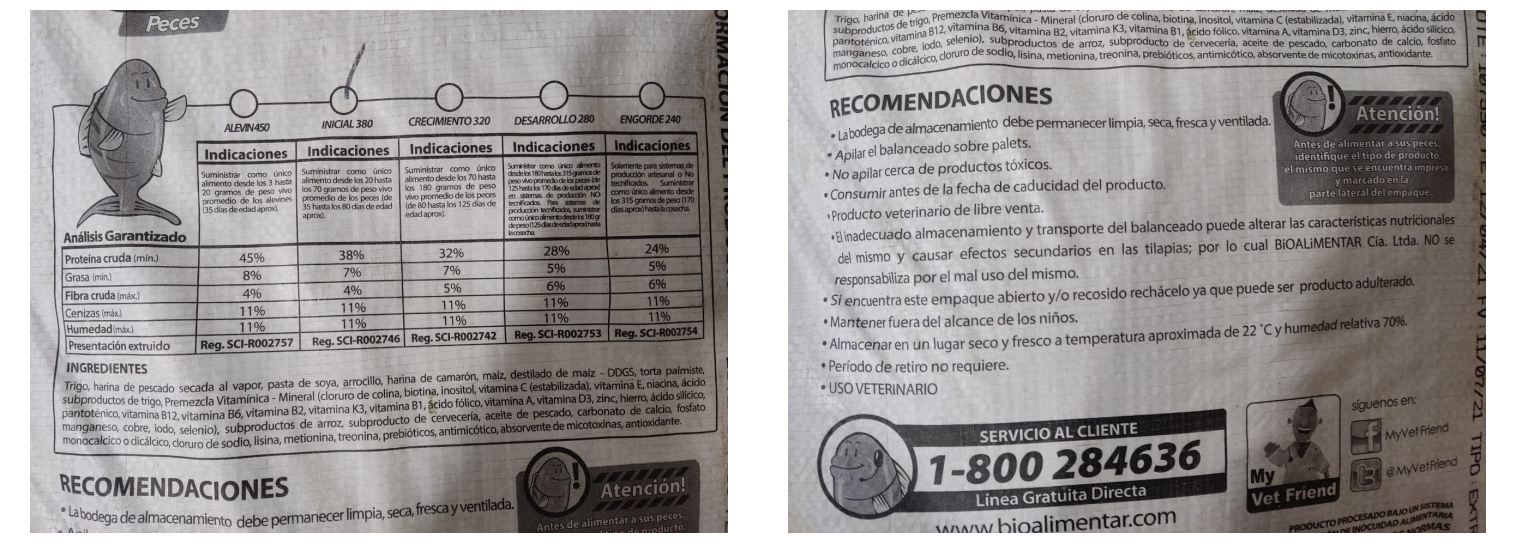
Tilapiacenter Iquique y Antofagasta, Quito



This farm is owned by Cindy's grandparents, Cindy, and they have fish hatcheries there.

Dehydrated mealworms float on water, full or in pieces

It is very easy to get to Cindy's grandparents' farm and if you need to stay there is a house where we can stay, and all this is free, the house is always available.



These are pictures from the feed based on fish rests. You can read the protein content

Food development

Raw materials such as amaranth, quinoa, cricket flour and tenebrio molitor larvae were obtained. A formula was made to determine the percentage of protein required by fry, juvenile and adult fish. Calculations:

To find the balance of protein required to be consumed by the fish, rules of three were performed which are detailed below:
Q=Quinoa
G=Cricket meal
P= Protein
T= Tenebrios molitor

Fry stage:
353 g Q ----> 45.89 g P
100 g G ----> 68.00 g P
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453g 113, 89 g P

453 g -----> 100
113, 89 -----> X
x= 113.89 x 100 / 453
x= 25, 14 % P

Juvenile stage:
For the juvenile stage 2 types of food were used which is based on pure larvae of Tenebrios molitor where: 50 g of tenebrios molitor contains 25.9 % protein.

Adult stage:
313 g Q ----> 40.69 g P
140 g G ----> 95.2 g P
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453g 135, 89 g P

453 g -----> 100
135, 89 -----> X
x= 135.89 x 100 / 453
x= 29, 99 % P

Experiment 1	Toast the amaranth grain; proceed to sift the cricket powder; weigh 10 g of amaranth and 4 g of cricket powder, then heat the amaranth grain and add the cricket powder, mix well and check the adhesion of the powder particles to the grain and buoyancy.	As a result, it was obtained that the powder did not adhere completely to the grain and did not present buoyancy.
Experiment 2	Toast 10 g of amaranth grain and add 5 g of cricket powder to it, let it stand at room temperature and then mix them to check the adhesion of the particles to the grain and the buoyancy.	As a result, the powder did not adhere completely to the grain and did not show buoyancy.
Experiment 3	Toast 10 g of amaranth grain and put it in a water bath; weigh 7 g of cricket powder and then add the powder to the grain, then mix.	As a result, a good adherence of the powder to the grain could be observed, but it did not have a good buoyancy percentage.
Experiment 4	Toast 10 g of quinoa and grind them to obtain a fine powder and heat it in a water bath, weigh 5 g of tenebrio larvae, these should be divided in half, then a mixture of the two is made and their adhesion and buoyancy is observed.	As a result, little adhesion was obtained, and low buoyancy, when interacting with water, the powder was detached.
Experiment 5	Toast 10 g of quinoa, grind them to obtain a fine powder, weigh 5 g of tenebrio larvae, these should be in pieces at room temperature, then a mixture is made, it was observed that it had a better adherence but low buoyancy.	
Experiment 6	Toast 9 g of quinoa and grind it to obtain a fine powder, sift 6 g of cricket powder, mix the two flours and then add 25 ml of water, mix and send it to the oven at 35°C.	As a result, a good adherence was observed, but low buoyancy, so it was concluded that the buoyancy depended on the compaction of the dough, reason for which the same procedure was performed again but this time compacting the dough in a better way.
Experiment 7	Toast 907, 18 g of quinoa and then grind it to obtain a fine powder, then sift 226.76 g of cricket powder and mix the flours dry, then add 600 ml of water and mix, later, due to the lack of freeze-drying equipment, we improvised with syringes to compact the mixture and shape it into pellets, then heat them at a temperature below 50°C to avoid denaturing the protein and finally we observed that they are completely dry.	As a result of the buoyancy tests, positive results were obtained, so the solution was reached and it was concluded that it is a type of feed suitable for fish feeding.

Field tests

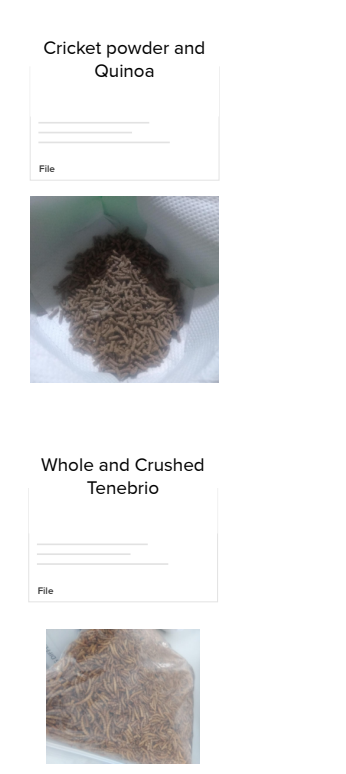
Videos

Cricket powder and Quinoa

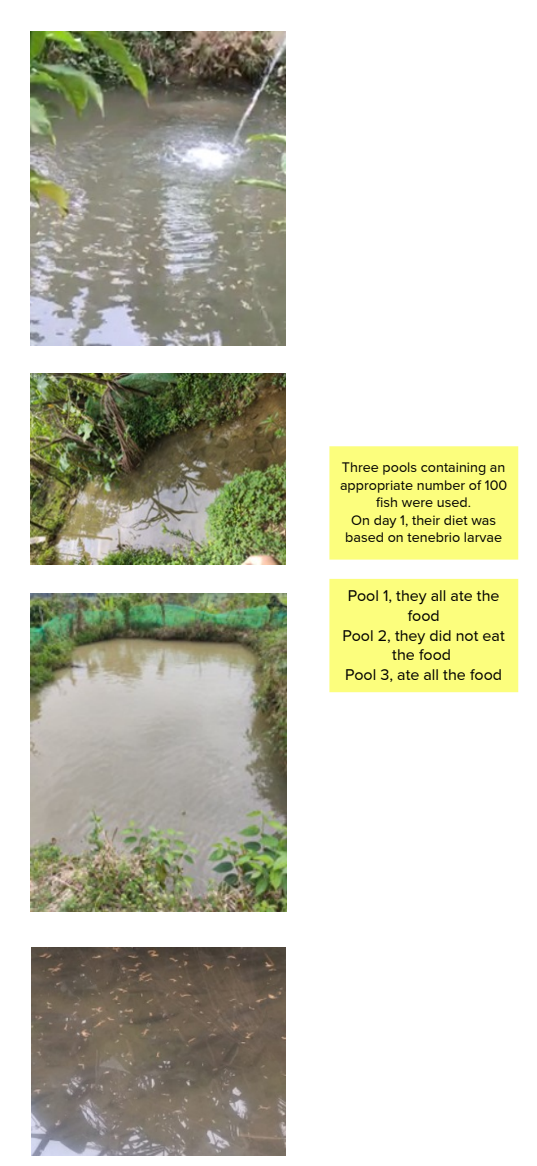
Cricket powder and Quinoa

Cricket powder and Quinoa

Whole and Crushed Tenebrio



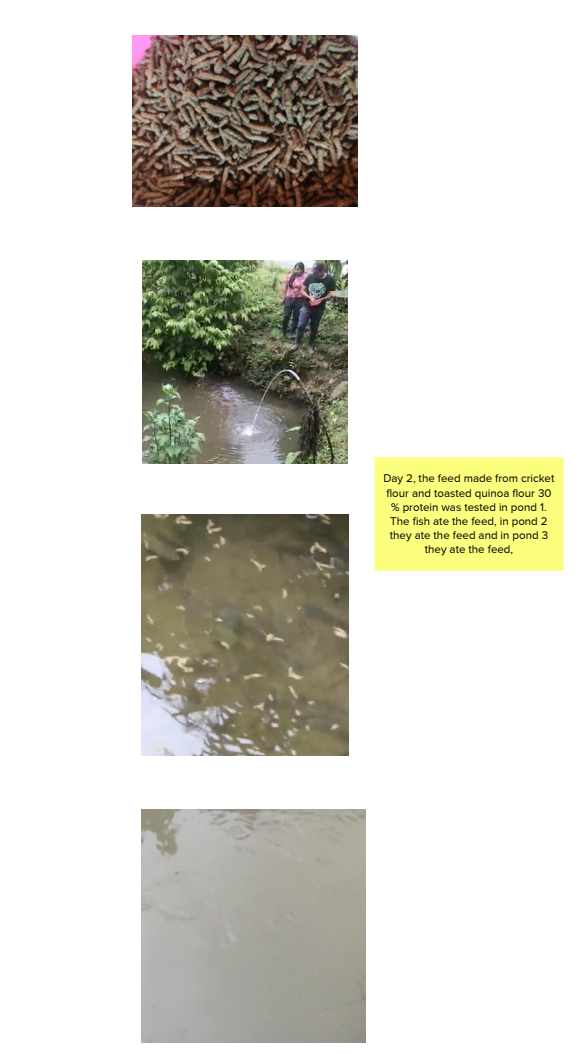
Day 1



Three pools containing an appropriate number of 100 fish were used. On day 1, their diet was based on tenebrio larvae

Pool 1, they all ate the food
Pool 2, they did not eat the food
Pool 3, ate all the food

Day 2



Day 2, the feed made from cricket flour and toasted quinoa flour 30 % protein was tested in pond 1. The fish ate the feed, in pond 2 they ate the feed and in pond 3 they ate the feed,

Day 3

Day 3. Feed prepared with cricket meal and quinoa meal at 30% protein is given in pool 1. The fish eat the feed, although they show interest in the slightly smaller particles, pool 2. Fish do eat the feed, pool 3 fish do eat the feed, pool 3 fish do eat the feed.

Thank you for sharing this great work experience with us.!!