

# CRAB JUICE

## How to turn invasive green crabs into a nitrogen-rich liquid fertilizer

### Beta version for testing and feedback, September 2019

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**SUMMARY:** Invasive green crabs (*Carcinus maenas*) contain some organic compounds that make them delicious as food and other compounds that make them nutritious to plants. What you have here is a way to make a **liquid fertilizer for plants** from green crabs. This crab juice, as we call it, is high in nitrogen, and will promote plant growth. Because of the high market demand for organic fertilizers these days – especially from cannabis growers – this recipe, or a variation on it, could become a real money-maker for green crab trappers and other entrepreneurs in coastal communities. But let's be very clear: What you have here is a beta version of the recipe, for testing. Your feedback and suggestions are requested.

### THE BASIC RECIPE:

If you have a supply of green crabs, here is the easiest way to make crab juice so you can test it yourself:

1. Drown the crabs overnight in fresh water, drain the water, put the crabs in a tub and walk on them in rubber boots to crush them.
2. Pour off the liquid extract *carefully*, because the liquid is what you will be working with.
3. Measure the liquid and add the same amount of ordinary white vinegar, so the crab juice and the vinegar are in a 1:1 ratio. This is your crab juice *concentrate*. Store it carefully in a tightly sealed plastic container.
4. Wash the outside of the container and your plastic tub (seawater works fine), and put the crab carcasses back where they came from (in salt water, too). Do this promptly ... to avoid creating a SMELL.
5. To use the fertilizer tea on plants, dilute one part crab juice concentrate with 30 parts water. (1:30 ratio) Only use as much as you need for a single watering session. You can test it on lawn grass, on cannabis, or whatever you like.

This is the *simplest* version of the recipe. If you want to produce more, or sell it commercially, and there will be a commercial market for it, you will want to know more. Here goes:

## WHAT'S INSIDE GREEN CRABS:

If you grind up whole crabs including the shells, you get a thick paste or slurry. It is actually about 70% water, according to tests from Penn State's agricultural testing lab, but the slurry is hard to work with as a fertilizing agent. It can't be sprayed through a nozzle or spread like a powder. So, instead, what we are doing is crushing the crabs coarsely, to release the fluids, the crab juice.

The green crab fluids are high in nitrogen, followed by potash and phosphate. These are the three classic ingredients of fertilizer. But crab juice, like other seafood-based fertilizers, is also relatively high in ammonium, which can convert to ammonia, which can become the basis of a powerful and unpleasant smell. The trick for reducing the smell is to lower the pH of raw crab juice, which is generally in 5.5 and up, to between 3.0 and 4.0 by adding acidic stabilizers. This stabilized crab juice concentrate can be stored and doesn't have much smell. Keeping the pH at the right level is the most demanding part of what is otherwise a simple process.

## THE FULL RECIPE – RECOMMENDED

### *You will need:*

A quantity of green crabs

A way to crush them (see options below)

An ordinary measuring beaker used for cooking

Mixing containers (bowls or tubs)

A stabilizer (the options are distilled white vinegar and muriatic acid, see below)

A simple, inexpensive way to measure pH (see below)

Well-made plastic storage containers with sealable, screw-on tops

A plan for disposing of the crab leftovers (carcasses) RIGHT AWAY to prevent smells

A water source, for rinsing all your equipment RIGHT AWAY to prevent smells

Advanced option: screens to filter out any particles that could clog spraying equipment

Advanced option: a cleansing/deodorizing agent for equipment: oxidizer permanganate or "pot perm"

### **Explaining your basic options:**

**CRUSHING METHODS:** Coarsely crushing the crabs into small pieces is best. Do not grind them up finely (that will create a paste) unless you have a press for extracting all the fluid.

- Cheapest method of small-volume crushing: Put the dead crabs in a plastic tub and just have somebody stomp on them with rubber boots. The bigger and heavier the person wearing the boots, the easier this will be.
- Large-volume mechanical crushing by a brush chipper or comparable machine, or even by putting the crabs in a tarp and running over them with a car or truck, so long as you can capture the liquids. Experiment with whatever you have or can afford to buy to see what works best.

**STABILIZERS:** These acidic ingredients stop the formation of gaseous ammonia and significantly reduce odors. They also stop fermentation so the containers will not expand or burst from gas pressure.

- Stabilizer option 1: Acetic Acid, or common distilled white vinegar. (The ordinary consumer version sold in supermarkets is about a 5% concentration, while commercial cleaning vinegar is about a 6% acid concentration. For our purposes it doesn't make much difference.) Vinegar is considered a "weak acid" and gets added to the green crab fluid extract at a 1:1 ratio, meaning that what you end up with is ½ crab extract and ½ vinegar. The advantage of vinegar is that it is readily available, familiar, and requires no special gloves or handling. If you are going to sell an organic version of crab juice and need it certified by the state, white vinegar might be the way to go. The disadvantage is that the concentrate with vinegar is bulkier and much more diluted in terms of its nutrients than if you use the other stabilizer, muriatic acid.
- Stabilizer option #2 – Muriatic Acid, available from some hardware stores including Home Depot and Lowe's and swimming-pool supply outlets, is commonly used in the spring to clean stained pool liners. NOTE: this is strong acid! Used with proper precautions of gloves and eye-protection, it will quickly stabilize the crab scraps by lowering the pH, which stops fermentation. The advantage is that you don't need much of it in crab juice: 10 units of liquid crab extract to 1 unit of muriatic acid, or a 10:1 ratio. So in each 1 gallon you will add 1 ½ cups. In 5 gallons you will add about 8 cups. Muriatic acid is also very cheap, about \$8/gallon and less in bulk. The disadvantages are that it has to be used with care, pouring and mixing with a plastic or rubber tool, but not with metal. And it isn't organic.

**Measuring pH.** To prevent smells and know how much stabilizer to add, you need to know how to measure on the scale between extreme acidity (1) and extreme alkalinity (14) where water is neutral (7). The equipment is easy to use, cheap, and available online.

- You should be able to buy a decent handheld pH meter from Amazon or wherever for under \$25 and then watch YouTube videos to understand how to use it.
- But the simpler, cheaper option is to buy paper pH test strips for kombucha brewing. These have a low, narrow range (and are therefore more accurate for acids in the range of pH 1 to 5.5). To meet the standard, the 5 range is greenish, and the 4 range turns orange and then lower at pH 3.0 is yellow.
- If wish to monitor the potential drift of pH, which can happen when the crab juice is stored, you can also buy a standard wide-range litmus pH paper which commonly go from 5 to 8 or even 1 to 14, but with less accurate in-between measurements.

**Advanced options to use or not use as you like:**

- In addition to rinsing the crabs, to get rid of the muck, sand, and microorganisms they may be carrying, you might want to either cook the crabs or boil the crab extract, to sterilize it. This adds a step of labor but your clients might require it if they are growing hydroponically and controlling all their inputs.
- Screens for straining out solid particles can prevent clogging of spraying nozzles: What the organic seafood industry leader Neptune's Harvest uses, according to its website, is a first filter at 165 mesh and a final 150 microns filter.
- Try salt water first for cleaning because it's free, but a cleansing solution, oxidizer permanganate, is used in the seafood industry for rinsing and de-odorizing equipment. Known as "Pot Perm", and also as "permanganate" it is an odorless bleach agent that an effective and safe deodorizer after handling crab scraps. It is available online. Prepare a solution using ½ cup of granules per gallon of water and pour on tools and containers and swirl and allow to stand. Soaking is recommended for full deodorizing; so the tools and containers can have a permanganate wash water left in them for 24 hrs or longer until it smells clean. Pot Perm is brightly colored purple and slowly loses all color as the oxidizer does the trick. It may be safely washed and poured down a drain.

#### **AND NOW THE RECIPE:**

##### **Step 1: Crushing the crabs, and keeping the fluid extract to work with**

1. Drowning the crabs overnight in fresh water kills them, and makes them much easier to handle
2. Preparing the crabs: You have choices. Up to you and your customers:
  - raw, unwashed crabs require the least labor from you;
  - rinsing the crabs to clear them of most of the mud, grit and microorganisms from their tidal habitat;
  - and finally cooking them as well as rinsing them, to sterilize them, which is the most labor-intensive
3. *Coarsely* crushing the crabs into small pieces is the goal.
4. Carefully pour off and keep the fluid extract; this is the valuable stuff you will be working with

##### **Step 2: Mixing to lower the pH and preserve the extract**

1. The pH of raw green crab fluid extract can rise quickly causing a bad odor; you are going to acidify or lower the pH level to a target 4.0 pH (or as low as 3) to help preserve the green crab fluid concentrate and prevent the worst odors.
2. While you will need a pH meter or pH litmus paper test strips for total accuracy, you can use volume measurements to get you in the ballpark. The ratio again is 1:1 or 50-50 if you are using distilled vinegar; or 9 parts volume of green crab fluid extract to 1 part volume of muriatic acid if you are using muriatic acid.

3. Mix the ingredients together, using the volume formula above mentioned. Always add the acids to the crab liquid, and not the other way around. After mixing and stirring you may check the pH with litmus paper or a handheld pH meter. Since the precise pH is not important, it is very acceptable to use pH strips. It is recommended to test the pH daily with this method to make sure it is not drifting upwards; if the pH is going up (becoming more alkaline) it is a sign that ammonia is forming. To control this simply add a little more acid (using much less than the original recipe) while checking the pH.
4. And that's the core of the process. Pour the concentrate into bottles and keep out of sunlight in plastic containers with tightly-fitting lids.
5. It is important to monitor jars during storage: if they are swelling it is a sign of some fermentation or pH drift. Either immediately use the product with appropriate dilution recipe below, or add some acid by the teaspoon while checking the pH range.

### **Step 3: Rinsing the equipment, and getting rid of the waste – IMPORTANT**

Green crabs are high in compounds that promote plant growth – but they are also high in protein and ammonium, which converts to ammonia, and makes the waste and the carcasses extraordinarily smelly.

If you rinse all your equipment and bottles right away you can avoid this problem; rinsing in salt water also works very well as a first step.

Unfortunately, there is no currently known way to use the solid waste products from this process – the green crab carcasses – in pure or near-pure form. The smell just becomes too powerful.

If you are dealing with small amounts, immediately put the crab carcasses back where they came from, in saltwater estuaries.

In larger quantities:

- have a plan prepared in advance to bury the carcasses a foot or so underground in a fenced garden; burying them shallowly in an unfenced garden invites animals to uproot them.
- give the carcasses to a farmer, who will mix the carcasses in with other compost ingredients or grind up and spread the crabs over fields with a manure spreader;
- or create your own specialized green crab compost by mixing them carefully with larger volumes of wood chips or bark (see Step 5 below).

### **Step 4: Diluting the concentrate for use on plants**

To use the stored concentrate of crab juice, you will need to dilute it with water since it is rich in nutrients and has been acidified by the treatment you used.

Only dilute as much concentrate as you will need at one time. Diluting a large amount will destabilize the mixture, increasing the pH and re-activating odorous fermentation.

Whether you have used vinegar or muriatic acid as your stabilizer, the dilution ratio is 1 parts concentrate to 30 parts water or about ½ cup in a gallon of water. (As a comparison, commercial fish-hydrolysates sold at garden centers, which are somewhat more concentrated, use a higher dilution of about are used at a dilution of about 1 : 50 to 1 : 100.)

(Note, however, that since the vinegar stabilizing method is 1:1 liquid crab extract to vinegar, before diluting with water, and the muriatic acid is 10:1 liquid crab extract to muriatic acid, before diluting with water, the muriatic acid method will have more crab nutrients per volume than the vinegar method. This is not necessarily a problem, but it is a fact, and it means the nutritional labels will have to be different for the different products.)

**Step 5:** Though it is somewhat time-consuming, and the results might not have much commercial value, green crab carcasses can be successfully **COMPOSTED** by mixing into a large amount of wood chips or bark. The best stabilizer and pre-compost ingredient is either bark mulch or peat moss, both commonly sold at home supply and garden centers.

To prepare a compost of crab scraps:

1. Obtain a bin composter such as "SoilSaver" available from Home Depot for about \$75, or any other brand that is similarly sized (about 70 – 80 gallons).
2. Obtain "bulking agent/ carbon" ingredient (bark mulch or peat moss or both).
3. Mulch is normally moist, but peat can be too dry. **MOISTEN** the peat if it is dry so that it feels like proper moist soil as in a potting mix.
4. Put down a firm layer of bark or peat on the ground in the bin; about 10" thick.
5. Add a 4" layer of bark-mulch or peat
6. Add a 4" layer of crab scrap
7. **REPEAT** these steps.
8. Cover the top with a thick 6" layer of bark or peat and close the lids.
9. **DO NOT** stir or mix the material for at least 1 week, in which time a lot of the odor and ammonia will be absorbed into the mass.
10. IF the mass starts heating, do not be alarmed- this is basically a good sign.
11. After 1 week, use a spading fork to dig into the top of the pile, observing odor and presence or absence of flies etc. If it is warm or heating, there may even be some steam given off. If the material gets really hot which is sometimes possible, and if it appears dry, sprinkle water on with a hose – keep to the rule it should look like good moist soil but not too moist. If the steam is odorous and appears to pose a complaint threat, add more peat or bark-mulch and remix.

12. ODOR / AMMONIA precautions: If the compost starts smelling of ammonia, you can help correct this naturally with garden grade gypsum (also called calcium sulfate). Do not use Limestone which is calcium carbonate. Calcium sulfate will absorb the ammonia without raising the pH. Generally, if your compost bins had 80-gallons full it probably weighs about 1000-200 lbs total and you want to add 1/10<sup>th</sup> this or about 10 lbs of gypsum to control the ammonia and high pH.
13. NOTE: you can use your pH strips or pH meter here (if you also got wide range strips) to check on this. Basically, now you are trying to keep the pH from going over 8.0, instead of the acid range. So if you can get it to neutral (pH 7), you are doing great!
14. To measure pH in a semi-solid media like compost, put a large pinch of the material in a cup of water, fill to about ½ full, and stir. Then insert the pH strip or meter probe into it.
15. How Long? Let the mass compost for 3 months – it will make a great soil conditioner by boosting the calcium and nitrogen. And the chitin from the crabs' shells will boost beneficial microorganisms in the soil, and also boost plants' immune system defenses.