Woods End Laboratories inc.

## Making your own liquid fertilizer

What's in your grass clippings, seaweed, chicken manure and urine and how can it be used safely and effectively as a nutrient source?

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## Woods End Report

**Exclusive For Mother Earth News** 

## INTRODUCTION

This report was commissioned to gain an idea of what it would be like to make one's own liquid fertilizer from natural ingredients obtainable around the home – including your own urine. The reason for this is that: liquid organic fertilizers are very costly (per unit of nutrient) and yet the ingredients themselves are readily obtainable. Why not prepare your own?

To perform the study we obtained and analyzed fresh grass clippings, fresh seaweed (*Ascophyllum nodosum*, or rockweed, off the coast of Bar Island, Maine) and dehydrated chicken manure from a breeder farm where replacement chicks are raised in open buildings on dry shavings bedding. We used our own grass cuttings straight from the Woods End campus. To analyze urine we relied on the extensive NASA report on composition of human urine; we did spot-test confirm TDS, pH and salinity and to model the dilutions we also analyzed heifer urine from a local organic farm (it was similar to human urine only richer in potassium and weaker in dissolved nitrogen.

As a preliminary study we tested how to make an extract by mixing these ingredients into tap water and allowing to stand for several days. We also tested shaking intermittently. It turned out that by day-3 most the potential extractable matter ("solubles") will have oozed out into the water solution.

We found that shaking did not significantly improve the extraction of solubles. This is probably due to the fact that natural cell lysis ("breaking of cell walls") and osmosis leaking of nutrients, is governed by time and temperature (we used room temperature - 72F). This finding is similar to the early University of Bonn (Germany) studies about preparing compost teas. They found that the quality and concentration of solubles in the watery extract were maximal if allowed to stand for 3-5 days with only once-daily stirring. So we settled on the best home method as being mixing  $1/10^{th}$  the material in water, and allowing to stand for 3 days, shaking or stirring once per day.

In the end the color of the extracts was variable but often quite dark (see picture). The color results from dissolved organic compounds. So a significant component of the liquid fertilizer – in contrast to chemical fertilizer- will be the presence of dissolved carbon (which we also tested for).

What's important to look for in making an extract, in terms of how it will affect plants? Possibly the most significant trait will be the salinity – level of dissolved salts. Following this will be the actual quantity of desired elements (like nitrogen and potassium) versus undesired (such as sodium and chloride). The separate presence of ammonium, one of several "species" of nitrogen (which includes urea, amino acids, nitrate, nitrite and ammonium). Urea and amino acids will invariably break down within 3-days into ammonium (NH4).

One way to determine the level of necessary dilution of these liquid fertilizers before use on plants, is to take the salt index and compare to expected nutrient ranges. We use the well known

"Hoagland" formula (named after Professor Hoagland of Rutgers University) still applied in practice as a recipe for preparing soluble nutrients used in horticulture. For greenhouse production, the modified "half-strength Hoagland" was compared with *Knott's Handbook for Vegetable Growers* (John Wiley & Sons), specifically the chart of suggested media nutrient levels for transplants. These tables and charts are conservative in the sense that they are designed to protect early seedlings from an excess of salts and nutrients which could damage growth. For full grown plants, the concentration can be slightly higher, and the timing of applications increased. By the way, pH (the level of acidity vs. alkalinity) was acceptable for all: between 6 and 7.5. In Table 1 we show the basic traits of the prepared fertilizers.

Liquid fertilizer:	% Total Dissolved Solids	Salinity mmhos/cm	Total Salts as mg / I	Ranking of Strength
Grass clipping s	1.0	5.0	3,000	Medium
Seaweed	0.5	3.0	2,000	Med-Low
Dried chicken manure	1.1	11.0	7,000	High
Human Urine	4.5	22.0	14,000	V. High

The next step was to look at the important constituent of soluble nitrogen- the element most likely to have a strong nutrient effect and the one that requires the most caution. This means we use N to set the required dilution before use.

Liquid fertilizer:	Total soluble nitrogen mg/l	Ammonium	Desired – N for liquid nutrients	Dilution to reach optimal N
Grass clippings	313	308	150 ppm	1:1
Seaweed	42	< 1		none
Dried chicken manure	374	350		1:1
Human Urine	4,000*	200		1:20

<sup>\*</sup> includes urea, amino-N, creatinine etc

Next we break it down into salt factors, listing the desired and undesired nutrients; as follows.

	All nutrients in parts per million (ppm)						
Liquid fertilizer	Chloride*	Sulfate	Sodium*	Potash	Magnesium	Calcium	Phosphorus
Grass clippings	407	23	2	1,235	70	72	251
Seaweed	173	96	356	162	42	31	228
Dried chicken manure	85	376	509	1,774	33	42	455
Human Urine	5,100	800	2,700	1,600	110	150	750

<sup>\*</sup> these are undesired salts.

Now, we determine what in fact we will end up with after we prepare the ready-to-use dilution. This table forms the basis of revealing true nutrient value of home-made fertilizer:

Liquid fertilizer	Nutrients in ppm			N	Nutrient Index*		
	N	Р	K	N	Р	K	
Grass clippings	157	126	618	1.0	0.5	3.1	
Seaweed	42	228	162	0.3	0.9	0.8	
chicken manure	137	228	887	0.9	0.9	4.4	
Human Urine	200	38	80	1.3	0.2	0.4	

<sup>\*</sup> in relative terms, with 1 indicating a close-match to Hoagland Nutrient Solutions

The end result of this test process is that we can confirm that all these materials produce very useful extracts in terms of conventional nutrients N-P-K. However, the group varies considerably. The urine must be the most cautiously handled for it requires a 20-fold dilution before it can be safely used; all other requires either none at all (seaweed) or a slight dilution.

The test also explains why when your dog lifts its leg and pees somewhere- on the grass or on a bush; you should expect to see damage! The soluble nitrogen content of mammalian urine is very, very high and this combined with the high salt index is a warning to improper use.

Which fertilizer best suits your needs? Urine will tend to push the green foliage aspect of plants; too much will mean that you are not likely to get much fruiting. Seaweed will push the least. We like the

grass clipping and poultry manure teas- both are surprisingly similar with lots of potassium (great for stem strength) in relation to nitrogen.

One word of warning; these extracts do ferment! All are biologically active. The grass extract fermented the most quickly, followed by the poultry extract. With fermentation all bets are off! The material can become odorous; the pH may change rapidly, and so on. This means you must use these extracts as soon as you prepare them – or within a day or two.

How easy was it to make and use the extracts? The hen manure was the easiest and gave the most satisfying test results. Grass was difficult because even though we used the same amount in weight per quart of water (1:10 weight basis), it filled the entire jar bulk wise (see picture), and had to be *pressed out* by hand. Seaweed was the most pleasant to handle- it smelled like the ocean the whole time, although it had the least overall nutrients. At the same time, the seaweed analysis shows why this is preferred as an autumn soil treatment: low in N it is relatively rich in P, K which are good for root storage.



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