

# NUTRITIONAL PROPERTIES OF AGROCOIR

Sponsored by

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### **INTRODUCTION:**

Coir fiber derived from coconut husks has become an increasingly popular growing media component. It is all natural, organic, recyclable, and is considered a fully “sustainable” growing media substrate. It is used as a complete, stand-alone substrate or as a component in growing media blends. Management of water and nutrients is similar to that for sphagnum peat. Available water held in its organic matrix is greater than that for sphagnum. Air porosity is high like that in coarse sphagnum peat. Coir holds nutrients in a manner similar to sphagnum but seems to provide a greater reserve of nutrients in the substrate with less run off. Additionally, disease suppression has been demonstrated in Coir. Coir is available from coconut producing areas. In North America Mexican coir is readily available. Compared to coir from Eastern Countries, Mexican coir is essentially free of sodium and very rich in potassium. In Mexico the AgroCoco Company is the major producer of coir for growing media. They have developed some specialized processing using the whole husk to produce more fibrous grades of growing media. The process takes more of the long fibers and incorporates them into the substrate. The fibers make the blend more porous with greater resilience against compaction. The fibers also resist deterioration making Mexican AgroCoir more suitable for long term crops than sphagnum peat. These more fibrous grades of coir can be used as “stand alone” substrates or incorporated into blends.

In order to take advantage of the superior physical characteristics of the Mexican coir it is essential to thoroughly understand its chemical properties and how they influence nutrient management in crops. Therefore, it was the purpose of this study to quantify the nutrients present in the various grades of coir produced by AgroCoco and to compare to the levels commonly observed in sphagnum peat. To accomplish the task both the total quantities of nutrients present and the solubility (availability) of those nutrients was measured.

### **COMPLETE MINERAL ANALYSIS:**

The complete mineral analysis of a growing media is usually achieved by combusting (burning) the organic matter and then dissolving the ash into an acidic solution. The acidic solution is then analyzed to quantify the minerals that are in the media. This process is often referred to as an ash analysis. It provides a measure of the total mineral content of a substrate or component. That measurement includes the minerals that are both available and not available to the plant. The available nutrients are mobile or can easily become mobile within the substrate matrix. The non-available minerals are usually a part of the structure of the media components and often slowly become available, or soluble, as the components deteriorate. That deterioration occurs through weathering, composting, decay, or in response to root exudates. Knowing what minerals are in a given substrate can provide information on what is likely to become available to the crop over time. Table 1. and Figures 1. through 6. present the results of complete mineral analysis of four grades of coir fiber compared with levels common in sphagnum peat.

**Table 1: Total Nutrient Content of AgroCoir Grades Compared to Sphagnum Peat**  
(Dry Weight Basis)

		Regular Coir	Coarse Coir	Fine Coir	Hydroponic Coir	Sphagnum Peat
<i>Percent</i>	<b>N</b>	0.51	0.39	0.49	0.57	0.40
<i>Dry Wt.</i>	<b>P</b>	0.08	0.07	0.08	0.09	0.02
	<b>K</b>	1.87	1.66	1.79	1.99	0.05
	<b>Ca</b>	0.15	0.13	0.14	0.17	0.30
	<b>Mg</b>	0.10	0.09	0.10	0.11	0.08
	<b>S</b>	0.07	0.06	0.07	0.10	0.05
<i>PPM</i>	<b>Fe</b>	237	241	263	289	220
<i>Dry Wt.</i>	<b>Mn</b>	9.79	8.38	12.79	18.43	8.00
	<b>B</b>	18.12	18.38	17.58	19.83	4.00
	<b>Cu</b>	15.99	17.37	12.98	7.84	4.00
	<b>Zn</b>	9.03	11.02	17.88	13.67	8.00

**SATURATED MEDIA EXTRACT:**

A Saturated Media Analysis (SME) provides measurements of readily available key plant nutrients using methods, developed at Michigan State University by D. Warnke & D. Krauskopf in 1983. The methods attempt to simulate what is available to the plant roots growing in light weight organic based growing media. Distilled or de-ionized water is used to saturate the media and after it equilibrates the solution is sucked off the media using a vacuum. The solution is then analyzed to estimate the nutrients that are available to the roots. The quantities of nutrients found in the extract provide information used to estimate the nutritional status of a substrate at a given time. Suggested levels for growing different crops serve as reference points to strive for while growing a crop. Frequent SME analysis provides an excellent method of monitoring and assuring good crop nutrition. Table 2. gives some SME results for various grades of coir and sphagnum. The differences are more clearly depicted in Figures 7 through 10.

**Table 2: Available Nutrients In AgroCoir Grades Compared to Sphagnum Peat**  
(Saturated Media Analysis )

		Regular Coir	Coarse Coir	Fine Coir	Hydroponic Coir	Sphagnum Peat
	<b>pH</b>	5.98	5.67	5.82	5.97	3.20
	<b>SS</b>	3.53	2.94	3.77	4.45	0.35
<b>Macro Nutrients</b>	<b>NO3</b>	7.22	7.09	6.41	6.73	6.00
	<b>NH4</b>	1.45	1.21	1.21	1.11	1.50
	<b>P</b>	8.72	7.13	10.02	12.85	0.50
	<b>K</b>	135.31	111.61	137.40	162.03	10.00
	<b>Ca</b>	3.56	3.31	4.44	5.59	3.00
	<b>Mg</b>	8.93	6.70	10.00	11.89	1.00
	<b>Na</b>	16.98	18.09	23.22	37.81	4.00
<b>Micro Nutrients</b>	<b>Fe</b>	0.17	0.08	0.28	0.17	0.08
	<b>Mn</b>	0.00	0.00	0.01	0.04	0.01
	<b>Cu</b>	0.01	0.01	0.00	0.01	0.01
	<b>B</b>	0.14	0.13	0.18	0.20	0.05
	<b>Al</b>	0.17	0.06	0.25	0.15	0.04

## THE DATA:

Samples of four grades of coir were analyzed by Micro-Macro Laboratory, a lab that specializes in agricultural soil and plant analysis. The samples included coarse, regular, fine, and hydroponic (very fine) grades. It should be noted that the results are from single samples and provide enough information to demonstrate the general nutritional characteristics of Mexican AgroCoir from AgroCoco and also show possible trends due to particle sizes.

## TOTAL MINERAL CONTENT

In Figure 1. we see that the mineral content of all four grades of coir have equal or higher concentrations of phosphorus, calcium and magnesium than is common in sphagnum. The coarse, more fibrous, grade of coir has lower nitrogen content and is approximately equal to that commonly found in sphagnum peat. The sulfur levels in the various grades of coir were only slightly higher than the level common in sphagnum peat. It is interesting to note that the hydroponic grade, which is the finest, showed the greatest concentration of minerals. That is suspected to be the result of the greater percentage of pith tissue present in the finer grade of coir.

In Figure 2. we see the concentration of potassium in the various grades of coir compared to the typical concentrations in sphagnum peat. The quantities of potassium are significantly higher (about 10 times greater) than is common in sphagnum. All grades of coir are rich in potassium but again the finest grades of coir (fine and hydroponic) have the highest concentration.

Figure 1.

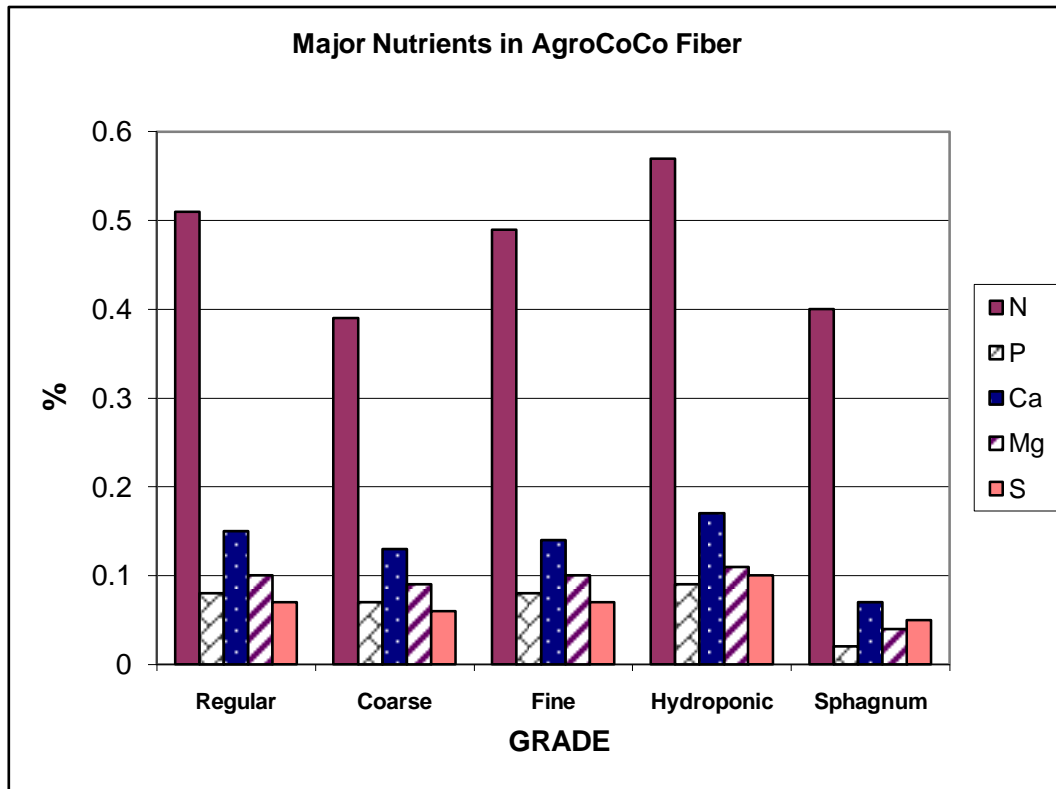
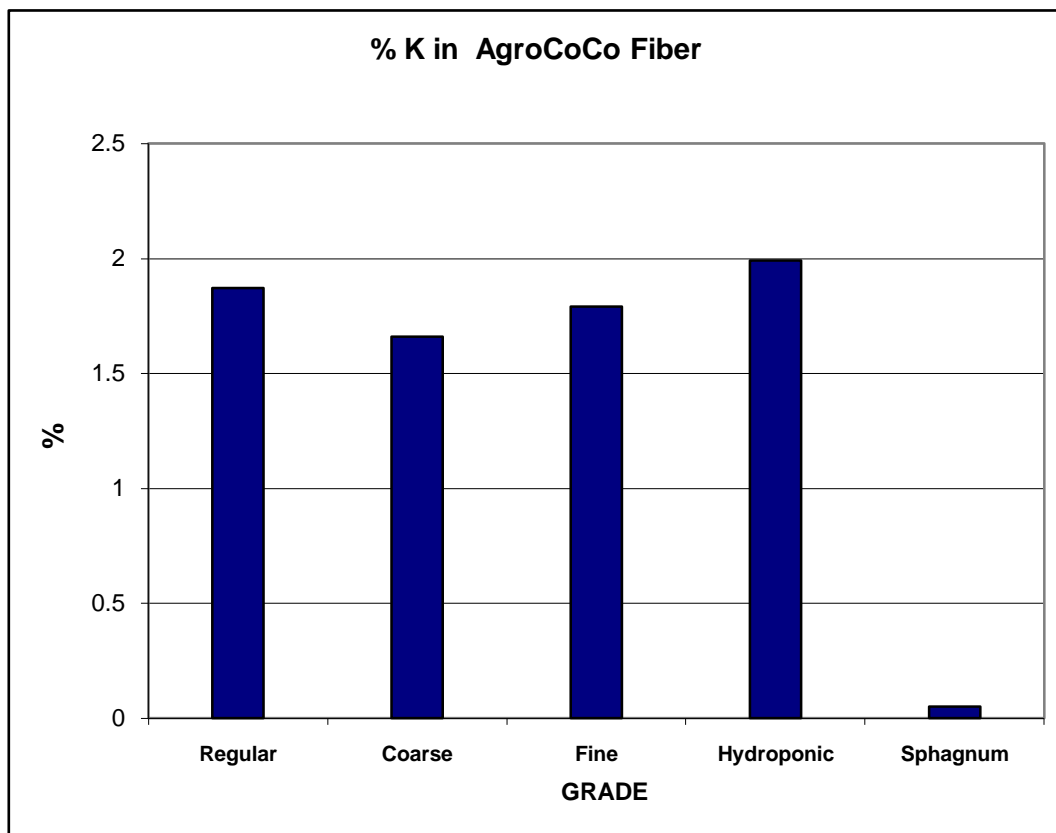
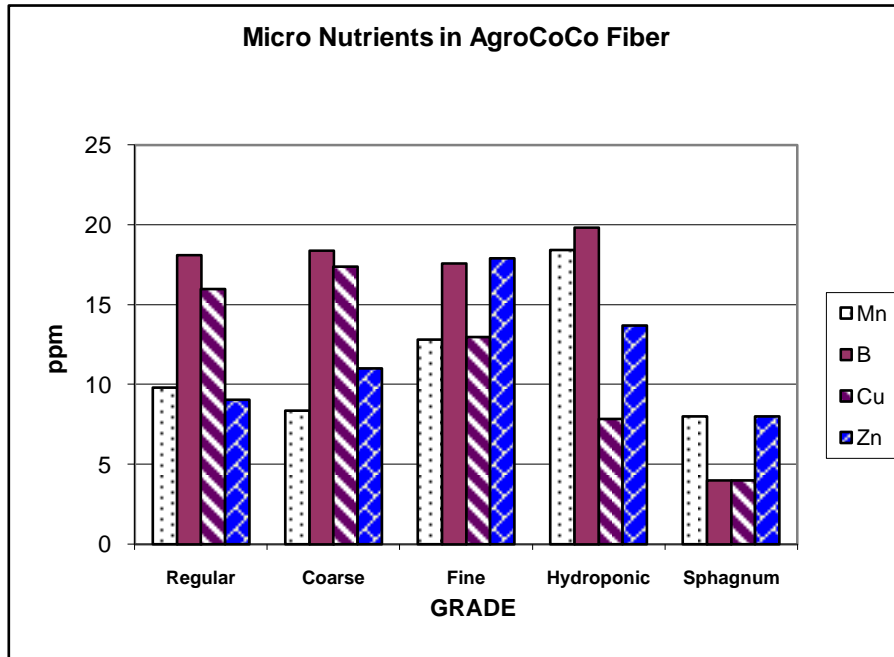


Figure 2.

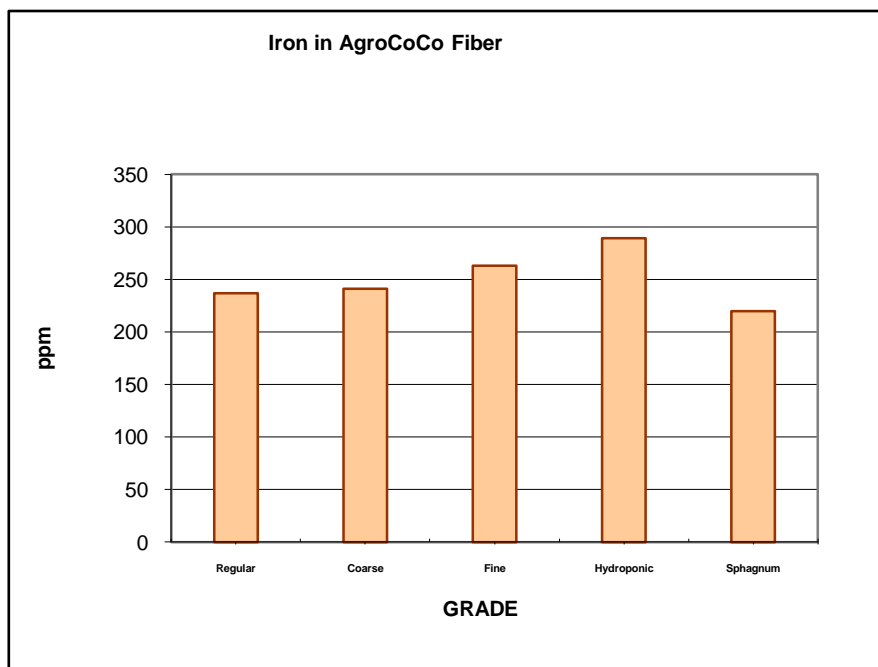


The concentrations of most essential micronutrients are presented in Figure 3. Again the micronutrient concentrations in the coir are approximately twice that common in sphagnum with the finer grades tending to have higher concentrations. The iron concentrations are depicted in Figure 4. The concentrations of iron were approximately equal to that commonly found in sphagnum. Again the coarser fibers showed a lower concentration of iron than the finer grades of Mexican AgroCoir suggesting a greater concentration of the micronutrients in the finer pith than in the coarser fibers.

**Figure 3.**



**Figure 4.**



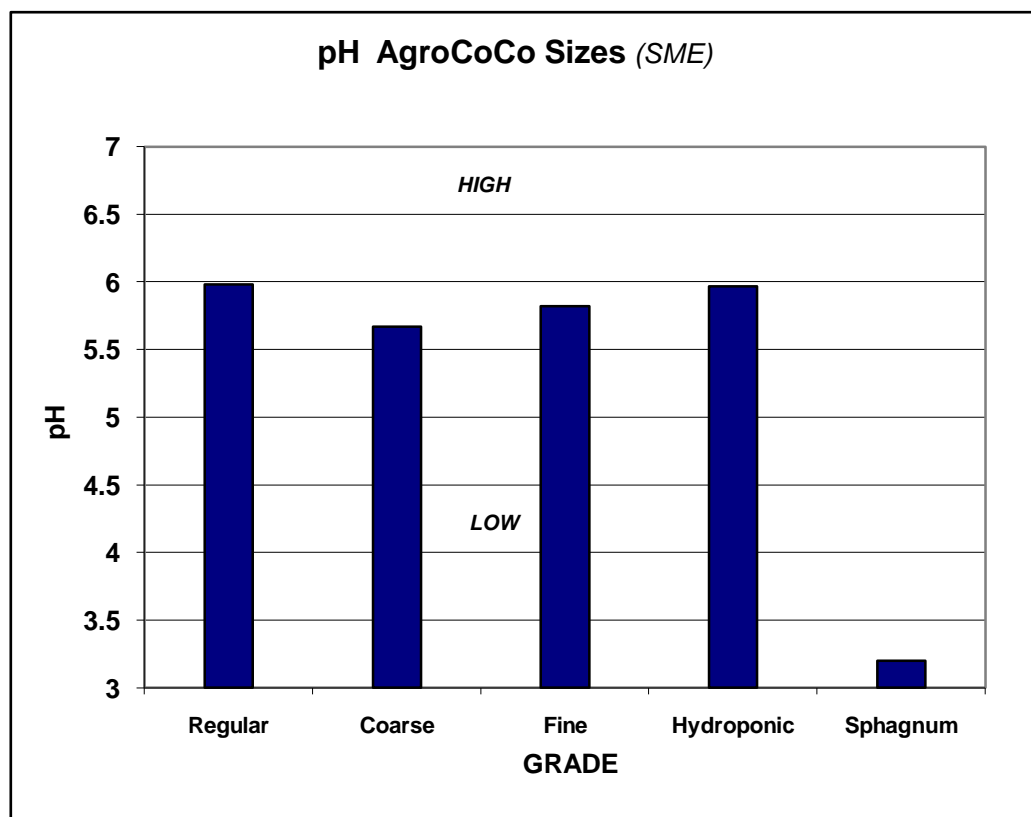
In the total mineral analysis we see that Mexican AgroCoir is richer than sphagnum in the majority of the nutrients and should be considered a significant source of potassium. The nitrogen, sulfur, and iron content of sphagnum are approximately the same for coir and sphagnum. The finer textured coir contains higher concentrations of most nutrients than the coarser more fibrous grades.

### PLANT AVAILABLE NUTRIENTS - SATURATED MEDIA ANALYSIS

The Saturated Media Analysis (SME) provides an estimate of the nutrients that are readily available to plant roots. It provides a measure of the soluble nutrients in a substrate. These measurements help to quantify the nutrients that can be readily absorbed by plant roots.

In Figure 5. we see the pH levels for the different grades of coir compared to sphagnum peat. All grades of coir showed pH levels between 5.6 and 6.0 while sphagnum was about 3.2. All grades of coir showed approximately the same pH. The coarse, more fibrous grade demonstrated a slightly lower value at 5.7. The near optimal pH values in coir likely arise from the comparatively high levels of potassium in the coir.

Figure 5.



The total soluble salts levels, as measured by the electrical conductivity (E.C.), range from adequate to high in all grades of coir. Those values are depicted in Figure 6. Again the coarse more fibrous coir has a lower quantity of total soluble salts than the finer materials. Sphagnum is much lower in soluble nutrients, especially potassium, (Figure 7).

Figure 6.

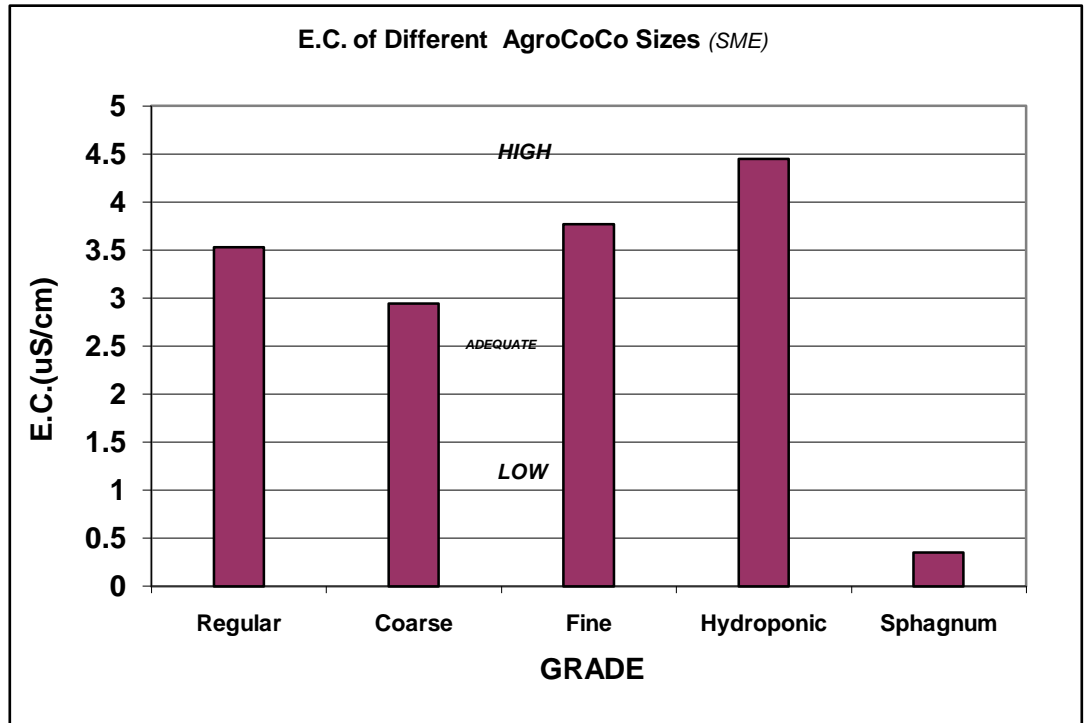
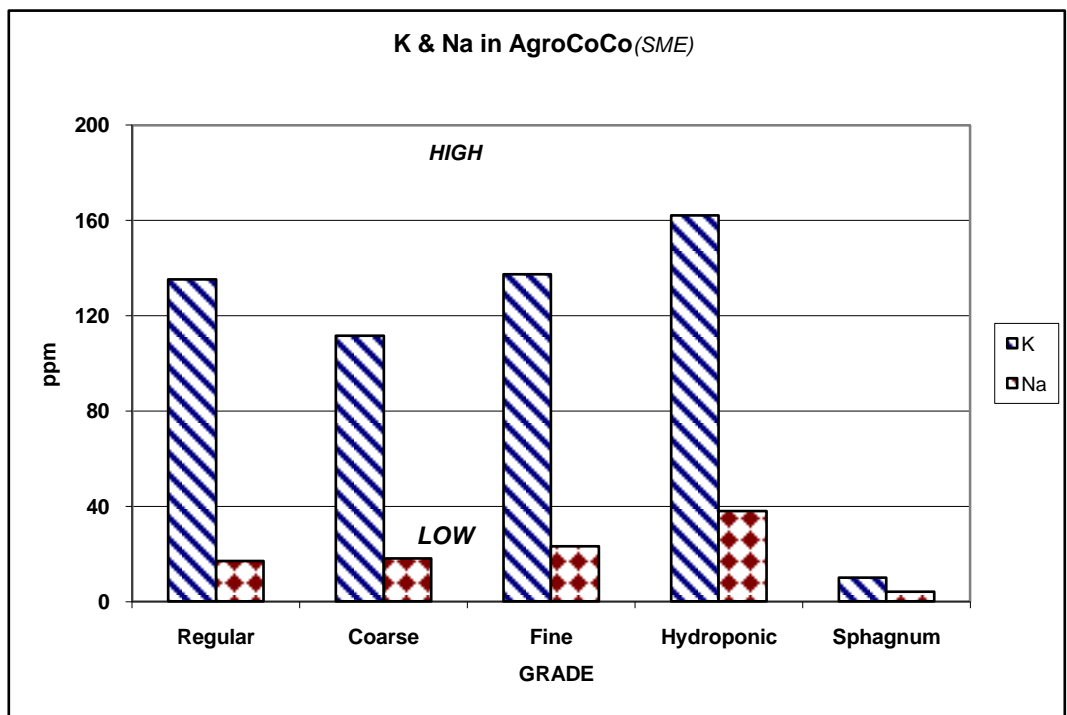


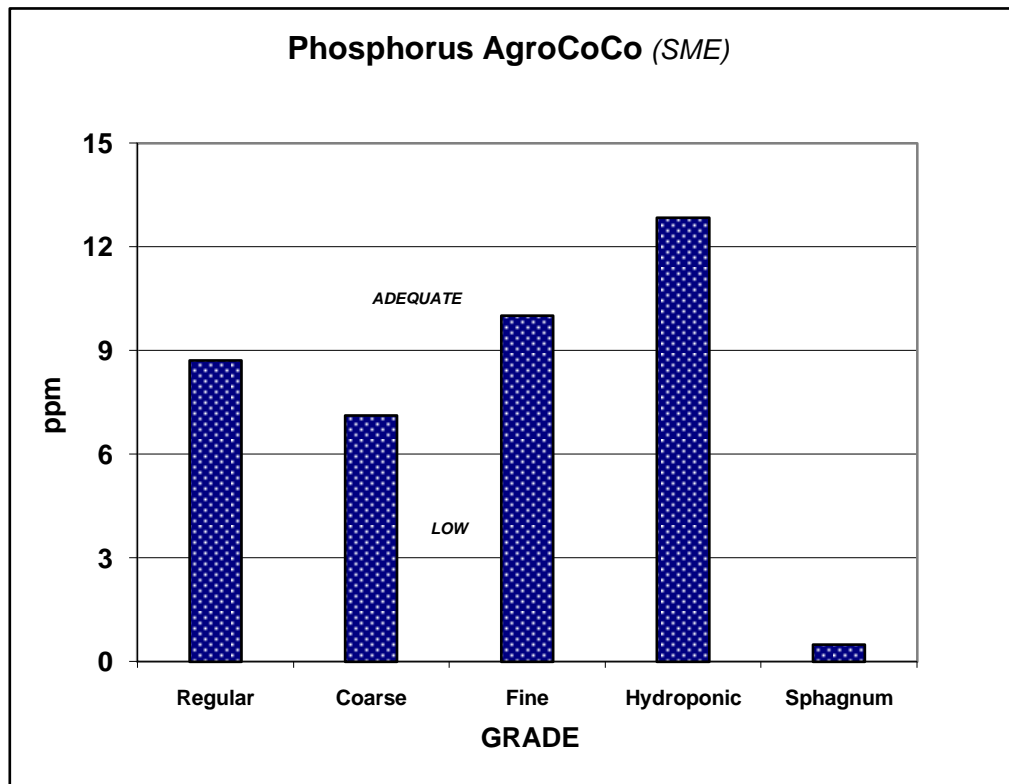
Figure 7.



Potassium is the primary ion contributing to the soluble salts levels in all grades of the Mexican AgroCoir (see Figure 7.). Surprisingly, sodium levels are very low compared to the levels commonly understood to exist in coir from the Eastern sources. Again the coarse fibers showed lower levels of soluble potassium and sodium. That mirrors the total mineral analysis showing lower potassium content (Figure 2) in the coarser fibers than in the finer tissue. This low sodium level makes Mexican AgroCoir of premium value in many agricultural applications, especially in organic growing practices. That potassium resource must be considered when adapting a fertility plan for coir based substrates.

Phosphorus is essentially absent in sphagnum peat (see Figure 8) while the levels in coir are much higher. These phosphorus levels are minimally sufficient to provide a starting point in most seedling, transplant, and crop production systems. However, the reserves of phosphorus (Figure 1.) are not sufficient to eliminate it from the supplemental fertilizer plan for production of long term crops. Again this reserve is sufficient to get most crops off to a good start but supplemental levels will be needed as growth progresses. This bonus of soluble phosphorus at an optimal natural pH level makes Mexican coir a good raw material in “organic” and “sustainable” crop production.

Figure 8.



Nitrogen levels expressed as ammonium (NH<sub>4</sub>) and nitrate (NO<sub>3</sub>) are very low in all grades of coir. That compares closely to levels found in sphagnum. Additional nitrogen is required in a fertilizer management plan. That presents two advantages. First the grower has full control of the crop growth by controlling the nitrogen levels and second the possibility of the development of ammonium toxicity due to decomposition and anaerobic fermentation is low.

Surprisingly, the calcium and magnesium levels are also very low in all grades of coir. While they are higher than what is common in un-limed sphagnum peat, the levels are not sufficient for good crop production. Usually substrates with near optimal pH levels contain more calcium and magnesium. In the Mexican AgroCoir we find that the higher pH is a result of the higher levels of potassium. In order to maintain balanced nutrition additional calcium and magnesium must be provided. If the irrigation water contains very high quantities of calcium and magnesium, as is often present in highly alkaline waters, then supplemental calcium and magnesium fertilizers may not be necessary. However, for most production systems additional calcium and magnesium must be incorporated into the fertility plan. It is helpful to blend gypsum and Epsom salts into a coir based substrate to help balance these important minerals. Calcium and magnesium nitrate, and Epsom salts serve as soluble sources of these important nutrients in many fertilization programs. It must be mentioned that monitoring substrate pH is more important in management of nutrition when the cation levels are variable. Coir tends to be more stable in pH than sphagnum but it is still important to frequently monitor the pH levels and adjust the fertilizer practices accordingly.

Figure 9.

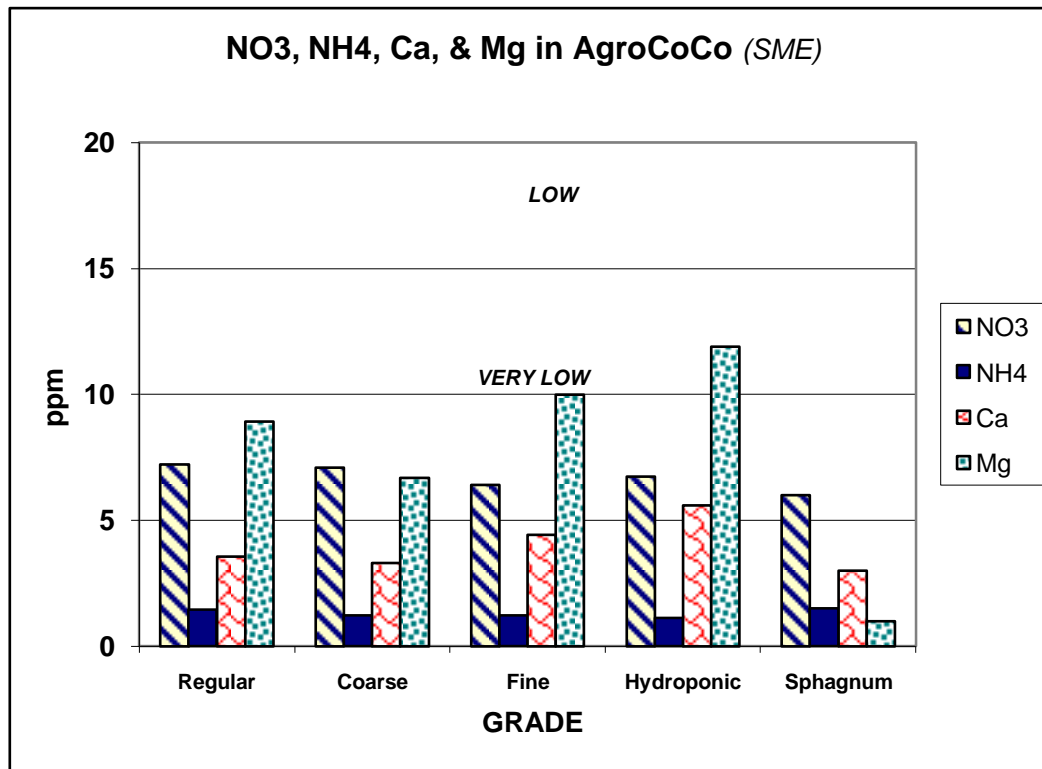
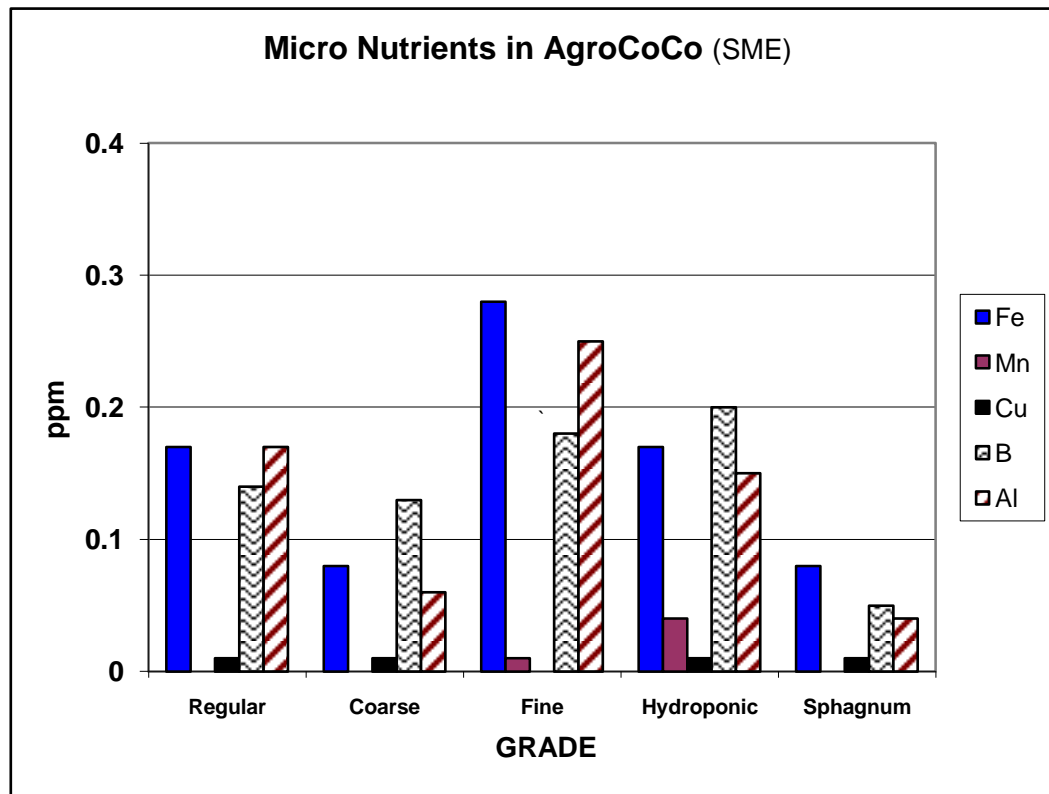


Figure 10.



Soluble micro-nutrient levels are considerably higher in all grades of Mexican AgroCoir than in sphagnum peat. While all micro nutrient levels are low in the samples tested they do provide some of the micronutrients needed in crop growth. Iron levels in the fine coir reached about 0.28 PPM in fine grade with only .06 PPM in the coarse grade. Those levels are about 1/3 the optimal iron levels for most crops. Manganese levels are hardly measurable in the finest grades (hydroponic and fine). All are well below the adequate ranges of 0.2 to 2.0 PPM. Some copper is measured in all grades of coir and sphagnum but the levels are also well below the .05 to .30 PPM range that is often considered adequate. Boron levels are also highest in the finest grades of coir and all fall within the desirable range from .05 to 0.5 PPM. Aluminum is not an essential nutrient but soluble aluminum is toxic at high levels. The levels in core are clearly insignificant and should cause no concern to growers. While the micronutrient levels are higher in coir than in sphagnum peat it is important to provide supplemental micro-nutrients to bring the levels closer to optimum levels.

## **SUMMARY:**

A balanced nutrient package in the substrate is always part of a good fertility management program. The nutrient management plan will vary by crop, season, container size, management goals and practices. No specific recommendations can be made here without knowing those goals and parameters.

In summary, compared to sphagnum peat, Mexican AgroCoir has a pH suitable for most crop production and does not require as much lime as sphagnum in blends. Mexican coir contains more of most of the major and minor nutrients, especially potassium and phosphorus. These nutrients contribute to the higher soluble salts (E.C.) levels. Mexican AgroCoir is not high in sodium as is common in many Eastern supplies of coir. It provides a supply of most micronutrients but that supply needs supplementation for most crop production.

The data indicates that the coir fiber from AgroCoco in Mexico can be used alone as a substrate or in blends replacing sphagnum and most other growing media components.