Sustainable Development and Color Reproduction Study of Tree-Free Paper

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Abstract

According to the Professional Association for Design (AIGA), paper manufacturing is responsible for the third-largest consumption of fossil fuels worldwide and the single-largest industrial use of water per pound of finished products. Awareness of these sustainability issues, paper manufacturers are making efforts to explore alternative fibers to provide paper choices for consumers, the starting point for the life cycle of print. This new generation of paper is being produced from plant fiber or mineral powder to provide tree-free alternatives. Plant-fiber paper usually requires fewer chemicals, takes less energy to process, and also tends to have higher potential in relation to bio-refineries. Mineral-based paper requires no chemical bleaching, uses much less water during processing, and when disposed it degrades back to the base component of mineral powder. This paper studied the color reproduction capability and process capability of four commercial available types of tree-free paper (20# sugarcane, 22# sugarcane, cotton, and stone) in terms of optical density and color gamut. All four paper types were tested using an inkjet printer, and the sugarcane and wood-based papers were also tested using a laser printer. It was found that, with the laser printer, 20# sugarcane copy paper was competitive with wood-based copy paper in terms of color reproduction capability, and was capable of producing consistent color gamut. When printed with the inkjet printer, the two sugarcane copy papers yielded lower optical densities and a smaller gamut volume than the wood-based copy paper, but were more capable of producing more consistent optical densities and color gamut than wood-based copy paper. The stone paper and cotton paper worked well with the inkjet printer but tended to have larger color reproduction variability.

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1. Introduction

Terms such as “Going Green” and “Green Graphic Design” have become hot topics these days as sustainability issues arise in industry. Anna Carlile, principle and founder of Viola Eco-Graphic Design, stated that (Sherin, 2008):

> *As global citizens, we have a duty to ensure that our work practices are sustainable, whatever the industry. In simple term, it’s about ensuring that the actions of today do not compromise the needs of future generations.*

The life cycle of print starts with paper choices. Specifying environmentally preferable paper products can reduce the effect that printing has on the planet. Over the past two centuries, wood has been the primary raw material in paper manufacturing. However, wood-based paper carries a significant “ecological shadow” of energy consumption, bleaching chemicals, and water used in its production. In its 2010 report, United Nations Environment Program (UNEP) identified pulp and paper industry as one of the largest direct contributors to human toxicity. The substances from paper and paperboard mills that contribute most to human toxicity impact are mercury (II) ion, beryllium, and hydrogen fluoride (Hertwich et al, 2010). Motivated by legislation, consumer pressure, and the desire to become more resource and energy efficient, the pulp and paper industry in the United States has invested in new technologies and processes that reduce its environmental impact. Using tree-free fiber in production is one way to minimize or eliminate the environmental impacts (Sherin, 2008).

1.1. Sources of Tree-free Fibers

Tree-free paper is made without the use of tree fiber. There are a variety of alternative fibers that can be used to make paper and reduce the demand on forests. Basically, tree-free paper can be divided into two main categories: organic and nonorganic (Dougherty, 2008; Sherin, 2008; Fiedor & Gray, 2005; Carver & Guidry, 2010).

Organic tree-free paper uses fibers derived from plant sources such as residues from agricultural crops, or plants grown specifically for papermaking.

- Agricultural residues (also called agri-fiber or agri-pulp) are left over materials from the harvesting of agricultural crops such as wheat, rice, cotton, flax, rye and sugarcane bagasse. These fibers, typically treated as a waste product, are considered the most preferable materials to be used for paper production because it makes the most of a waste material and doesn’t require dedicated agricultural land.

- Purpose crops listed in Table 1 are tree-free crops grown specifically to make paper.

Non-organic paper made of minerals uses little to no water in their production processes, releases fewer emissions, and uses just under half the energy of wood-based paper production. They are durable, water resistant, and considered highly recyclable. However, since recycling facilities are not widely available for these materials, books made from mineral alternatives have a high risk of ending up in landfills (Dougherty, 2008; Sherin, 2008; Fiedor & Gray, 2005; Carver & Guidry, 2010).

Purpose Crops	Characteristics
Hemp	• Fiber yield is roughly twice that of pine. • Reaches heights of 1.8 to 5 meters in 70 to 100 days. • Contains a mixture of both long and short fibers. • Strong and durable fibers require minimal bleaching due to their naturally light coloration. • Low in lignin can be broken down more quickly with fewer chemicals. • Can be blended with ling fiber post-consumer waste to add strength. • Not widely embraced in industry due to high costs and regulatory problems
Kenaf	• Fiber yield is roughly 3-5 times higher than pine's. • Reaches heights of 3 to 5.5 meters in five months. • Contains a mixture of both long and short fibers. • Great papermaking characteristics use fewer chemicals, and less heat and time in the pulping process (contains only 9% lignin). • Can be quickly pulped with harmless chemicals such as hydrogen peroxide.
Bamboo	• Grows faster than wood. • Can be regrown from established roots without replanting. • Comes from Asia and requires long distance transportation.
Cotton	• Two types of fibers used in papermaking: textile scraps and cotton linters, used in high-end papers for many years. • Processed with minimal chemicals.

Table 1: *Purpose crops used to create paper*

1.2. Challenges of Tree-free Fibers

Tree-free fibers have advantages of producing paper with fewer chemicals, less energy, and less water than wood, offering farmers alternative crop options, promoting biodiversity by relieving pressures of deforestation, and taking advantage of readily available fibers not being utilized. On the other hand, some studies indicate that the use of purpose crops may require more frequent doses of fertilizer and pesticides, but do not necessarily support the substitution of these fibers for wood pulp. Most environmental groups even argue that annual crops do not provide the secondary benefits of tree plantations, including wildlife habitats and carbon trapping (Kinsella, 2004; Sherin, 2008).

Today, agricultural residues are being used in some parts of the world. In North America, however, no major paper manufacturer has made a big commitment to these fiber sources. Increasing the market share of non-wood fibers is difficult due to a lack of production facilities for tree-free papers. In most cases, tree-free fiber is more expensive, not available in large quantities, and faces challenges in manufacturing because mills may have to be redesigned or retrofitted to accommodate these new materials in the papermaking process (Fiedor & Gray, 2005; Kinsella, 2004).

So far, the applications of tree-free paper are focused on stationery and office copy paper use. Several kenaf and hemp products mixed with recycled paper fibers and tree-free paper manufactured from agricultural residues (such as coffee, mango, lemon, and banana) used to produce quality stationery, add different elements to design. These products have made it to market, but none have been a big success so far. Tree-free paper made from sugar cane bagasse, on the other hand, has made some inroads in the North American office paper market. It biodegrades faster than wood-based paper, and can be recycled with paper made from trees. Table 2 provides a comparison of commercially available tree-free papers, with wood-based paper as reference. Factors used for comparison include: paper weight, use of optical brightener agent (OBA), paper white indicators (CIE $L^*a^*b^*$), color gamut volumes for laser and inkjet printers, and price based on standard 8.5"x11" size. With the exception of cotton paper, tree-free paper designed for stationery is produced without using OBA, while tree-free copy paper still uses OBA to bring up the desired brightness. Regarding paper weight, all the tree-free stationery papers are similar to or heavier than wood-based paper. The color gamut for the sugarcane papers is similar to the wood-based copy paper for laser printers and slightly lower for inkjet printers. Finally, tree-free paper is consistently more expensive.

2. Methodology

In order to study the color reproduction and process capability of tree-free paper, four commercially available tree-free papers (20# sugarcane copy paper, 22# sugarcane copy paper, cotton paper, and stone paper) were selected and tested, with a wood-based copy paper as reference. Two types of digital printers were used in the study: a Xerox DocuColor 250 laser printer with toner-based inks (profiled as a CMYK device), and an Epson Stylus Pro 4800 inkjet printer with UltraChrome K3 pigmented inks (profiled as an RGB device). All four tree-free papers were printed and compared using the inkjet printer. For the laser printer, the stone paper was not

Paper	Paper Weight	OBA	Paper White			Color Gamut		Price $ (8.5"*11")
			L*	a*	b*	Laser	Inkjet	
FSC certified wood-based copy paper								
Wood-based	20#	Y	95.53	1.94	-6.54	357,100	163,000	~ 0.01
Tree-free copy paper								
Sugarcane	20#	Y	92.64	4.3	-10.05	356,700	134,000	~ 0.02
Sugarcane	22#	Y	93.17	3.95	-10.25	379,000	135,000	~ 0.02
Tree-free stationery paper								
Banana	75 gsm	N	90.95	1.79	0.97	290,400	123,000	~ 0.10
Hemp	24#	N	91.13	1.63	3.85	242,200	91,000	~ 0.11
Cotton Paper	190 gsm	Y	98.30	2.42	-5.44	-----	334,300	~ 0.60
Stone Paper	240 gsm	N	96.77	0.12	0.41	-----	268,600	~ 0.15

Table 2: *Properties of commercially available tree-free papers*

tested because of difficulties encountered feeding it through the fusing unit, resulting in paper jams. And the cotton paper, which is specifically designed for inkjet printers, was also not tested on the laser printer.

The color reproduction consistency and capability of tree-free paper were evaluated in terms of optical density and color gamut. Forty samples of each paper type were collected from the selected digital printers and measured with an X-Rite i1iO spectrophotometer. ProfileMaker 5.0.10 was used to generate ICC profiles. These profiles were then loaded into CHROMiX ColorThink Pro 3 software to determine the gamut volumes. The optical densities of the four tree-free paper samples were measured using an X-Rite 530 Spectrodensitometer. One of indices used to measures process capability is Cp index. It is defined as the ratio of the designated specification range to the individual paper type process range, for optical density and color gamut parameters (Montgomery, 1997; Hsieh, 2003). Cp index is calculated as (upper specification limit - lower specification limit)/(6*Sigma). In other words, this ratio expresses the proportion of the range of the normal curve for each paper type that falls within that specification limits. For this study, a relative specification range was determined based on data for the selected paper types and used to calculate the Cp indices, as described below.

3. Results and Discussion

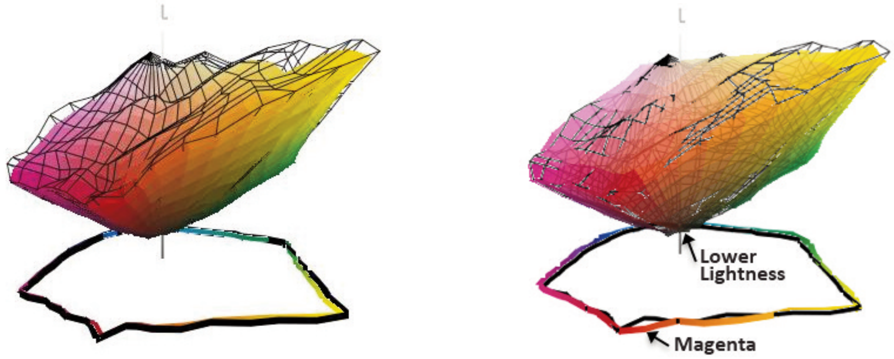
3.1. Color Reproduction Study

Color-related attributes of the tested copy papers include optical density and color gamut. Table 3 lists these attributes for the wood-based and sugarcane paper samples from the laser printer. Color density values are shown for yellow (Y), magenta (M), cyan (C), and black (K). The average optical density and color gamut measurements of the 20# sugarcane copy paper were close to those of wood-based copy paper. Although the 22# sugarcane copy paper had slightly higher average optical densities and produced a wider color gamut, it had larger color reproduction variability.

		Wood-based		20# Sugarcane		22# Sugarcane	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Optical Density	Y	0.92	0.018	0.94	0.016	0.97	0.014
	M	1.33	0.026	1.32	0.024	1.38	0.031
	C	1.41	0.025	1.42	0.023	1.48	0.031
	K	1.59	0.029	1.60	0.023	1.69	0.034
Color Gamut		357,134	17,190	356,753	12,677	379,013	22,405

Table 3: *Color-related attributes of tested tree-free papers using laser printer*
Note: S.D. represents Standard Deviation (Sigma).

Figure 1 illustrates the color gamut comparison for the wood-based and sugarcane copy papers. Note the black projection line represents the color gamut of the wood-based paper reference. The color gamut of 20# sugarcane copy paper (1a) was similar to that of wood-based copy paper, while that of 22# sugarcane copy paper (1b) is larger, especially in the magenta and lower L* values regions.



a) 20# sugarcane copy paper (true color) vs. wood-based copy paper (wireframe)

b) 22# sugarcane copy paper (true color) vs. wood-based copy paper (wireframe)

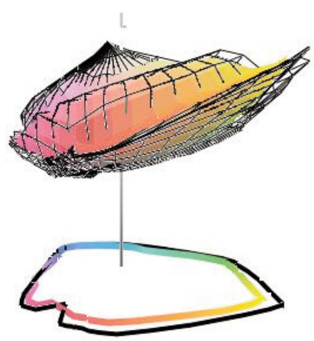
Figure 1: *Color gamut comparison for the copy paper using a laser printer*

Table 4 shows the color-related attributes of tested copy papers using the digital inkjet printer. Cotton paper, which is specifically designed for inkjet printers, yielded the highest M and K optical densities and produced the widest color gamut but exhibited higher color reproduction variability. Compared to the wood-based copy paper, sugarcane copy papers (20# and 22#) produced lower optical densities, smaller gamut volume, and smaller color reproduction variability. With the same amount of ink, stone paper produced the highest Y and C optical densities, a wider color gamut than the wood-based and sugarcane papers, but with the largest color reproduction variability for all optical densities.

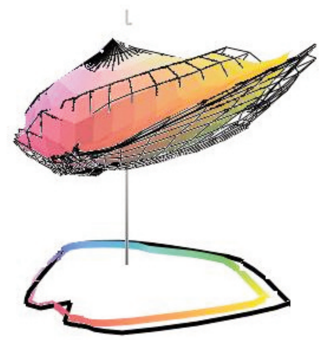
The color gamut comparisons for the tested tree-free paper using an inkjet printer are shown in Figure 2. The sugarcane copy papers (a and b) yielded a smaller color gamut, compared to wood-based copy paper that produced a wider color gamut in yellow and magenta areas. Stone paper worked well with the inkjet printer using plain paper setting. With the same amount of ink, stone paper (c) yielded a wider color gamut than wood-based copy paper did. As expected, the color gamut of the cotton paper (d), designed for the inkjet printer, is larger than that of the wood-based copy paper.

		Wood-based		20# Sugarcane		22# Sugarcane		Stone Paper		Cotton Paper	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Density	Y	0.72	0.006	0.69	0.005	0.68	0.006	0.84	0.010	0.79	0.005
	M	0.53	0.004	0.47	0.007	0.50	0.005	0.65	0.017	0.83	0.004
	C	0.60	0.005	0.53	0.004	0.53	0.006	0.71	0.012	0.63	0.003
	K	0.71	0.005	0.69	0.006	0.69	0.005	0.89	0.022	1.28	0.006
Color Gamut		162,956	16,878	133,870	12,503	135,023	9,933	268,589	11,089	334,369	18,938

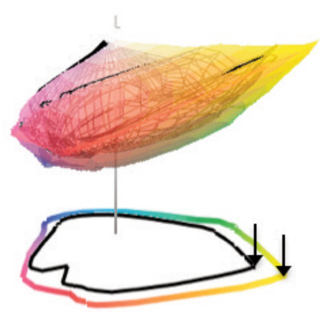
Table 4: *Color-related attributes of tested tree-free papers using inkjet printer*
Note: S.D. represents Standard Deviation (Sigma).



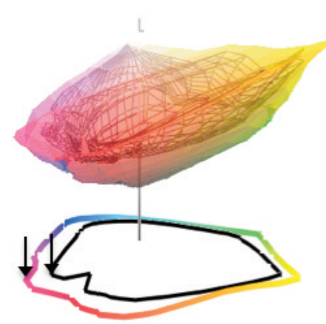
a) 20# sugarcane copy paper (true color) vs. wood-based copy paper (wireframe)



b) 22# sugarcane copy paper (true color) vs. wood-based copy paper (wireframe)



c) Stone paper (true color) vs. wood-based copy paper (wireframe)



d) Cotton paper (true color) vs. wood-based copy paper (wireframe)

Figure 2: *Color gamut comparison for the tested tree-free paper using inkjet printer*

3.2. Capability Analysis

The tools within the Minitab software used to analyze the consistency for optical density and color gamut measurements are individual control chart (I chart), moving range charts (MR chart), and capability analysis. Individual control chart (I chart) and moving range charts (MR chart) were used to remove the outlier data. The capability analysis tool was used to calculate Cp index for each paper type.

In order to do the capability analysis, lower specification limit (LSL) and upper specification limit (USL) are required input parameters. However, due to lack of historical parameters of LSL and USL for color-related attributes of paper, relative specification limits were determined using test data. After eliminating all outlier points, revised Sigma (the process standard deviation) was calculated for each paper type and the average Sigma was computed from the Sigmas of wood-based and sugarcane papers for both laser and inkjet printers. In addition, average Sigma was computed for all five tested paper types for the inkjet printer. The relative LSL and USL (Tables 5, 6, and 7) were obtained by subtracting and adding the appropriate average 3*Sigma value from each individual paper type mean, respectively.

		Wood-Based		20# Sugarcane		22# Sugarcane	
		LSL	USL	LSL	USL	LSL	USL
Optical Density	Y	0.8692	0.9777	0.8824	0.9909	0.9135	1.0220
	M	1.2507	1.4146	1.2335	1.3974	1.2932	1.4571
	C	1.3303	1.4925	1.3383	1.5005	1.4012	1.5634
	K	1.5100	1.6629	1.5200	1.6733	1.6151	1.7684
Color Gamut		328,752	366,722	331,099	369,069	372,804	410,774

Table 5: *The relative LSL and USL using average Sigma for wood-based and sugarcane paper samples: LASER PRINTER*

		Wood-Based		20# Sugarcane		22# Sugarcane	
		LSL	USL	LSL	USL	LSL	USL
Optical Density	Y	0.7047	0.7275	0.6794	0.7022	0.6651	0.6879
	M	0.5147	0.5423	0.4564	0.4841	0.4836	0.5112
	C	0.5940	0.6130	0.5197	0.5388	0.5243	0.5433
	K	0.7105	0.7530	0.6638	0.7062	0.6660	0.7084
Color Gamut		146,335	168,185	128,810	150,660	121,892	143,742

Table 6: *The relative LSL and USL using average Sigma for wood-based and sugarcane paper samples: INKJET PRINTER*

		Wood-Based		20# Sugarcane		22# Sugarcane		Cotton		Stone	
		LSL	USL	LSL	USL	LSL	USL	LSL	USL	LSL	USL
Optical Density	Y	0.7039	0.7282	0.6786	0.7030	0.6443	0.6887	0.7778	0.8022	0.8248	0.8491
	M	0.5167	0.5403	0.4585	0.4820	0.4856	0.5092	0.8162	0.8398	0.6349	0.6585
	C	0.5925	0.6145	0.5183	0.5402	0.5141	0.5448	0.6200	0.6420	0.6990	0.7210
	K	0.7172	0.7463	0.6705	0.6995	0.6726	0.7017	1.2665	1.2955	0.8785	0.9076
Color Gamut		141,415	173,105	123,890	155,580	116,972	148,662	323,369	355,059	255,427	287,117

Table 7: *The relative LSL and USL using average Sigma for all tested paper samples: INKJET PRINTER*

Using LSL and USL values in Tables 5, 6, and 7, the relative Cp indices were calculated. Results for color attributes for each paper-printer combination are shown in Tables 8, 9, and 10. A higher Cp index indicates more capable or more consistent results from the printing process.

Process Capability Analysis Using Laser Printer

Table 8 shows the capability analyses of wood-based and sugarcane paper samples from the laser printer. For the optical density yellow, the 22# sugarcane copy paper had the largest relative Cp index (1.28), followed by wood-based paper (Cp = 0.90) and 20# sugarcane paper (Cp = 0.90). Wood-based paper had the largest relative Cp index for optical densities magenta (Cp = 1.27) and cyan (Cp = 1.13). The 20# sugarcane copy paper, on the other hand, had the largest relative PCR for the optical density black (Cp = 1.17) and color gamut (Cp = 1.90). Overall, 20# sugarcane copy paper was the most capable of producing consistent color gamut among the tested papers in terms of relative Cp index. The 22# sugarcane copy paper, on the other hand, was the least capable paper for delivering consistent results in optical density and color gamut among the three tested papers, with the exception of optical density of yellow. Appendix A provides graphical presentations of the capability analyses of color attributes for the tested tree-free copy papers using laser printer.

Cp index		Wood-Based	20# Sugarcane	22# Sugarcane
Optical Density	Y	0.90	0.90	**1.28**
	M	**1.27**	0.99	0.83
	C	**1.13**	1.05	0.86
	K	0.98	**1.17**	0.89
Color Gamut		1.60	**1.90**	0.54

Table 8: *The relative Cp index for wood-based and sugarcane paper samples: LASER PRINTER*
Note: ***Bold*** *indicates the best performance in the category.*

Process Capability Analysis Using Inkjet Printer

Table 9 lists the capability analyses of wood-based and sugarcane paper samples from the inkjet printer. The 20# sugarcane copy paper had the largest relative Cp index for the optical density yellow (Cp = 1.34), while the 22# sugarcane copy paper had the largest relative Cp index for the optical densities cyan (Cp = 1.17) and black (Cp = 1.90), as well as for the color gamut (Cp = 2.39). Wood-based copy paper, on the other hand, had the largest relative Cp index for the optical density magenta (Cp = 1.69). Overall, 22# sugarcane copy paper was capable of delivering consistent results in optical density and color gamut, compared to wood-based copy paper. Appendix A provides graphical presentations of the capability analyses of color attributes for the tested tree-free papers with the inkjet printer.

Cp value		Wood-based	20# Sugarcane	22# Sugarcane
Optical Density	Y	0.99	**1.36**	0.80
	M	**1.69**	0.60	1.37
	C	0.78	1.16	**1.17**
	K	1.30	1.07	**1.90**
Color Gamut		0.53	1.42	**2.39**

Table 9: *The relative Cp index for wood-based and sugarcane paper samples: INKJET PRINTER*
Note: ***Bold*** *indicates the best performance in the category.*

Table 10 summarizes the capability analyses of all tested paper samples using the inkjet printer. The 22# sugarcane copy paper had the largest relative Cp index for the optical densities yellow (Cp = 1.55) and cyan (Cp = 1.89), as well as for the color gamut (Cp = 3.46). Cotton paper had the largest relative Cp index for the optical densities magenta (Cp = 2.81) and black (Cp = 2.60). Overall, sugarcane copy paper was capable for delivering consistent results in color gamut, compared to wood-based copy paper. The stone paper, on the other hand, was the least capable paper for delivering consistent results in optical density and color gamut among the tested papers. Cotton paper was capable of producing consistent optical density but had the worst performance in color gamut.

Cp value		Copy Paper	20# Sugarcane	22# Sugarcane	Stone Paper	Cotton Paper
Optical Density	Y	1.06	1.45	**1.55**	0.67	1.45
	M	1.44	0.51	1.17	0.89	**2.81**
	C	0.89	1.34	**1.89**	0.53	1.96
	K	0.89	0.74	1.30	0.74	**2.60**
Color Gamut		0.77	2.06	**3.46**	0.87	0.56

Table 10: *The relative Cp index for all tested paper samples: INKJET PRINTER*
Note: ***Bold*** *indicates the best performance in the category.*

4. Conclusions

Achieving uniformity of printing and obtaining good color reproduction performance are crucial in the print production. This study investigated the copy paper application of tree-free alternatives. It was found that, with the laser printer, 22# sugarcane copy paper was competitive with wood-based copy paper in terms of color reproduction capability. However, it had larger color reproduction variability. In other words, 22# sugarcane copy paper was the least capable paper of delivering consistent results in optical density and color gamut when printed with the laser printer. The tested 20# sugarcane copy paper was the most capable of producing consistent color gamut among the tested copy papers. With the inkjet printer, both sugarcane copy papers (20# and 22#) yielded lower optical densities and a smaller gamut volume than the wood-based copy paper did. However, tested sugarcane copy papers were capable of producing consistent optical densities and color gamut, with the exception of density magenta. Wood-based copy paper tended to be the most capable paper of delivering consistent results in magenta, either using laser printer or inkjet printer. Stone paper is compatible with the inkjet printer and is capable of producing higher optical density and color gamut, but it has larger color reproduction variability in terms of process capability. Cotton paper, designed for the inkjet printer, was capable of producing consistent optical density but had the worst performance in color gamut. The constant evolution in more eco-friendly materials is an ongoing process to minimize the environmental impacts. Although tree-free paper is facing a lot of challenges, results of this study indicate that acceptable performance is attainable for certain applications and printer types. Users can choose sugarcane 20# copy paper as alternative when consistency is the highest priority, while use sugarcane 22# when a wider range of color is needed. Stone paper printing with inkjet printers can add different elements to design. These products do represent new opportunities for increased choice in environmentally preferable materials and can be explored as a potential way to reduce the rate of hardwood deforestation. These types of paper could also support economic development in developing countries where they currently burn crop residue. With significant consumer demand by publishers and consumers alike, these alternative fiber options may become more accessible alternatives in the future.

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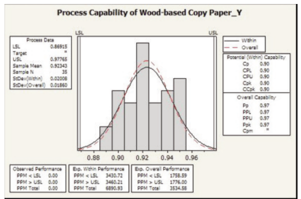
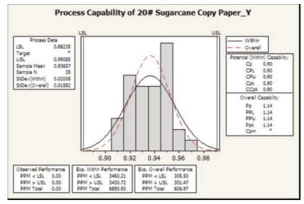
Appendix A: Process Capability Analysis

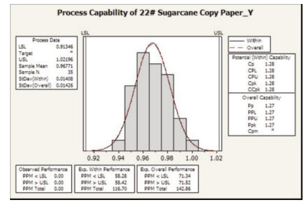
Optical Density (with the Laser Printer)



Wood-based Copy Paper

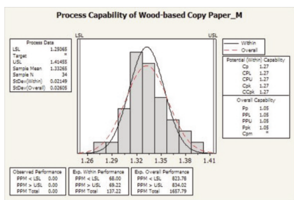


20# Sugarcane Copy Paper

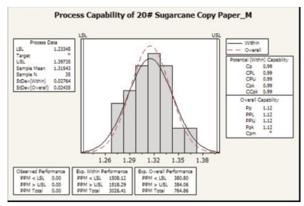


22# Sugarcane Copy Paper

Capability analysis for optical density of yellow (Y)



Wood-based Copy Paper



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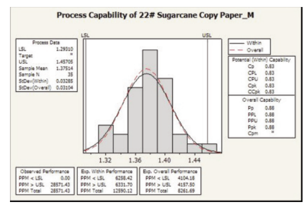
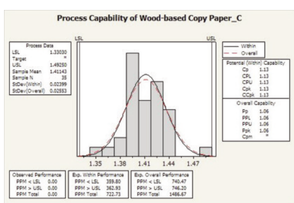


22# Sugarcane Copy Paper

Capability analysis for optical density of magenta (M)



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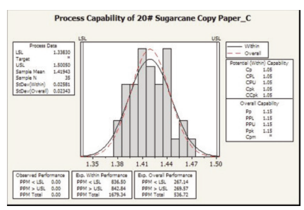

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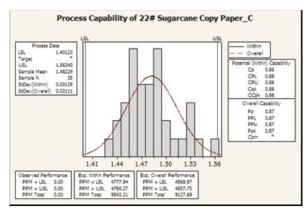
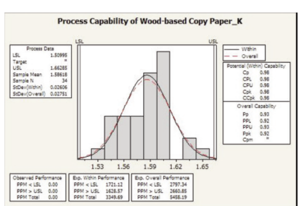


22# Sugarcane Copy Paper

Capability analysis for optical density of cyan (C)



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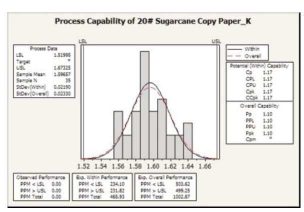

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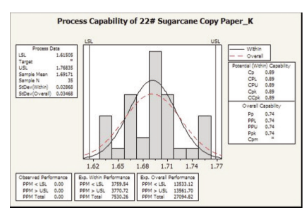
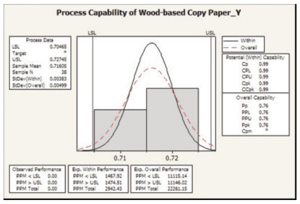


22# Sugarcane Copy Paper

Capability analysis for optical density of black (K)

Optical Density (with the Inkjet Printer)

Capability analysis for optical density of yellow (Y)



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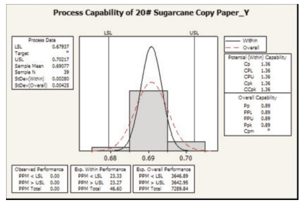

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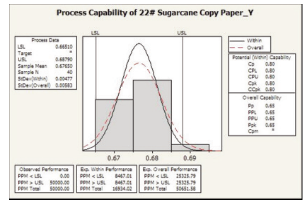
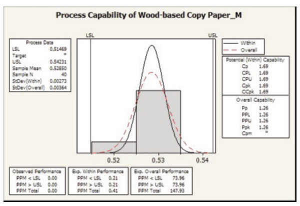


22# Sugarcane Copy Paper

Capability analysis for optical density of magenta (M)



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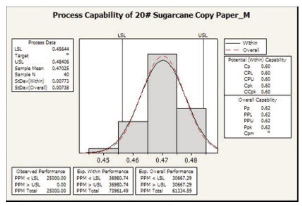

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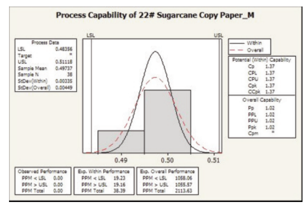
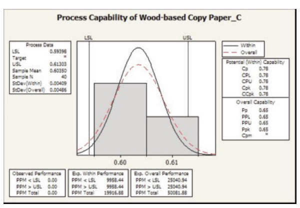


22# Sugarcane Copy Paper

Capability analysis for optical density of cyan (C)



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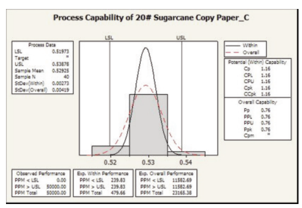

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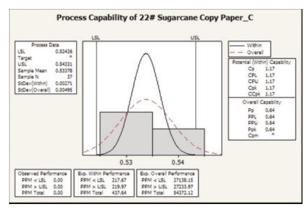
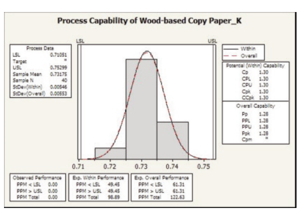


22# Sugarcane Copy Paper

Capability analysis for optical density of black (K)



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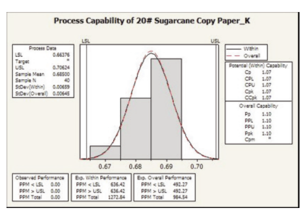

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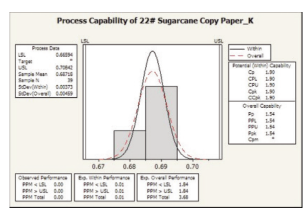
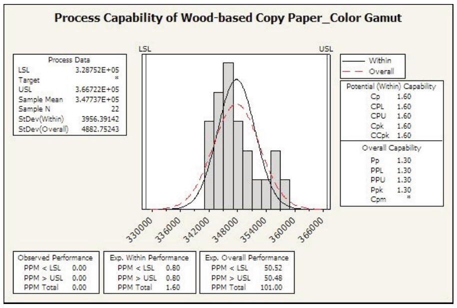


22# Sugarcane Copy Paper

Color Gamut (with the Laser Printer)



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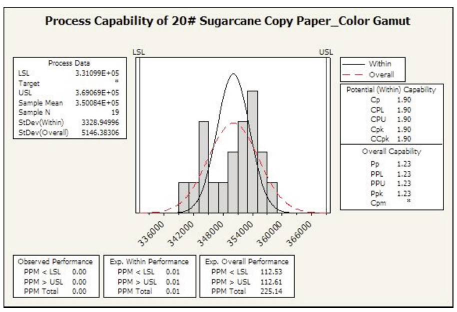

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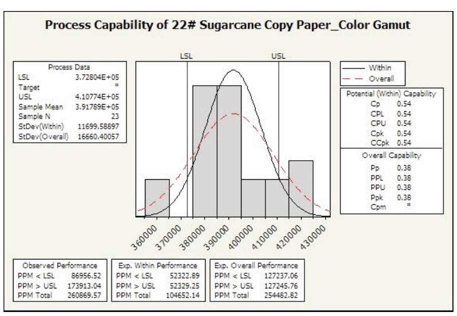
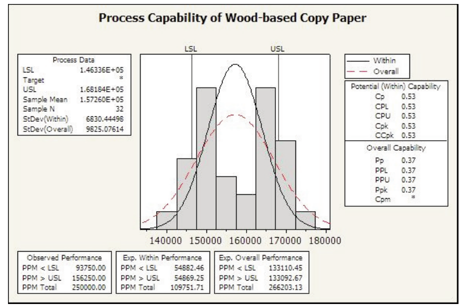


22# Sugarcane Copy Paper

Color Gamut (with the Inkjet Printer)



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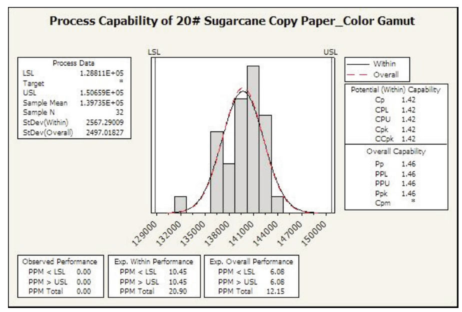

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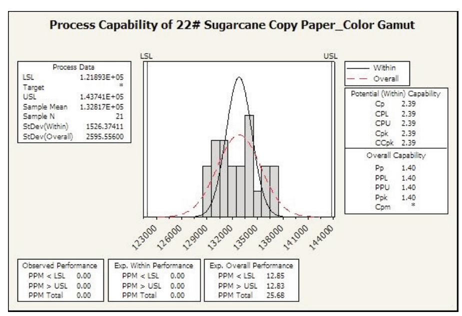

22# Sugarcane Copy Paper