

Executive Summary

This report addresses concerns and arguments about the true cost of ink in desktop photo printing. Using the Epson R2400 and Epson R1900, we conducted a series of print tests to determine how much ink is used in a full coverage 8"x10" print. From that figure we extrapolated ink usage per square inch. The objective is to share a realistic cost per print vision with inkjet users. The choice to pursue photo inkjet printing is in the end an individual economic choice.

The summary of ink cost by print size

	4x6	5x7	8x10	11x14	13x19
R2400 PK	\$0.27	\$0.40	\$0.90	\$1.75	\$2.80
R2400 MK	\$0.23	\$0.33	\$0.76	\$1.45	\$2.33
R1900 PK	\$0.19	\$0.28	\$0.63	\$1.22	\$1.96

Explanation of our methods and calculations used are below.

Preface

The "true cost of inkjet printing" is a source of constant debate in the media and on web forums. With claims of ink costing five to ten thousand dollars per gallon, it's not a mystery why the debate continues. Still, inkjet printer sales and printing continue to increase and studies indicate this trend will continue in the short and mid-term. Do the majority of end users simply not care about the cost, or do they know something that is missing from the discussion? This report looks at the cost of ink per square inch for two Epson desktop printers. The goal is to determine the cost for various popular print sizes, and to report those numbers. Further, we hope to spark more discussion and debate about the merits of inkjet printing in light of its unique ability to offer on-demand continuous tone photo reproductions that will last many decades.

Methodology

Two hundred 8x10 prints of Bill Atkinson's printer test were made. The montage of photos in Atkinson's image provided near 100% coverage, used a wide variety of colors, and presented what amounts to a worst-case scenario of ink usage. A pre-primed printer was loaded with new and previously unopened ink cartridges. The image was resized to 8" x 10" at 300ppi.

Prints were made using Best Photo (1440dpi) quality, High Speed printing turned on, within a color managed workflow. Inks were changed only when the printer stopped and indicated an empty tank. At the 200th print, a count was made of ink cartridges used plus an estimate of remaining ink cartridges. From that information, total use of ink in equivalent number of ink cartridges used was obtained. The ink usage was equated to amount per square inch and then converted to specific photo sizes.



Bill Atkinson's test image.
Used with permission.

Ink cartridge use calculations

New cartridges were installed at the beginning of the test. At the end of printing:

- 1) Number of cartridges replaced (including the starting cartridge) was tallied
- 2) Remaining cartridges were evaluated for amount remaining and thus volume used

For final ink estimates, a screen capture was made of the Epson Status Monitor, which shows a display of ink cartridge status. From the screen grab, a graph breaking the ink level into 10% increments was used to make an estimate of ink remaining. It was assumed that the Status Monitor display offered an acceptably accurate account of how much ink was in the cartridges. From previous experience we observed the printer quitting immediately or just after a cartridge displayed “dry”. That proved helpful in making estimates of ink left per cartridge. (See end section for all screen grabs)

For the purpose of this experiment, the question of how much ink is left in an “empty cartridge” is moot. If the printer quits then effectively the cartridge has run dry. The final results focus on actual yields, not questions of lost milliliters in spent cartridges.

Cartridge Equivalent Usage

In order to quantify the total amount of ink used for 200 prints, the number of tanks replaced must be added to the amount of ink remaining in the printer. To describe that number, we created the Cartridge Equivalent Usage measure (herein CEU).

CEU has two parts:

- 1) The number of tanks depleted and replaced
- 2) The amount of ink left in the remaining tanks

To depict the ink used in the remaining cartridges, a chart was created using the graph mentioned above. From that graph the amount of **ink used** in each remaining cartridge was recorded in percent terms. The percentage for each tank was added, then divided by 100 to provide the CEU of the remaining ink cartridges.

The CEU of the remaining tanks was added to the number of cartridges physically changed. This number was the total CEU for the 200 prints. Dividing the total CEU by 200 gave the CEU per 8” x 10” print.

Equation for CEU

Sum of the % used for remaining tanks / 100 = CEU of remaining tanks

CEU remaining + Cartridges changed / 200 = CEU of 8x10 print

CEU of 8x10 print / 80 square inches = CEU per Square Inch

Summary

The cartridge usage of each printer is listed below

Printer	8x10 Prints	CEU	Cartridges / Square Inch Usage
Epson R1900	200	10.2	.000625
Epson R2400 PK	200	14	.0009
Epson R2400 MK	200	11.5	.00075

Costs in Dollars

Our calculations are based on the current Red River Paper price for R2400 and R1900 inks.

	R2400	R1900
Cost	\$12.75	\$12.90

Using the CEU figures, we've extrapolated the cost of ink by print size (roughly 100% coverage)

	4x6	5x7	8x10	11x14	13x19
R2400 PK	\$0.28	\$0.40	\$0.91	\$1.76	\$2.83
R2400 MK	\$0.23	\$0.33	\$0.77	\$1.47	\$2.36
R1900 PK	\$0.19	\$0.28	\$0.65	\$1.24	\$1.99

Equation: Cartridge per Square Inch x Square Inches x Cost of one ink cartridge = Ink Cost Per Print

Sources of Error

We acknowledge that there are potential errors in testing and calculations. They are listed below:

- Inaccuracy of the remaining cartridge usage figures – The accuracy of the Epson Status Monitor could be called into question. From observations during the printing phase however, the display was consistent in its changes downward. Also, the printer stops immediately or very soon after the display shows no ink.
- “Real world” variables – The types of images printed can make a difference in the overall ink usage. Also, how often a printer is used will change ink usage slightly. Long periods of being left on, automatic cleaning, and manual cleaning cycles all play a role in overall ink usage.

Given possible sources of error, it is fair to attach a margin of error of +/- 10% to our results.

Conclusion

Red River Paper always assumed and communicated with customers that \$1.00 worth of ink per 8"x10" print was to be expected. At current ink prices, that is probably an overestimate. However, given potential sources of error, using the \$1 figure could be applicable for those pessimistic of our calculations.

What does this mean then to the photographic community at large? In our opinion it is and always has been up to the end user. The value one places on print quality, convenience, speed, control, and media availability is what determines if inkjet is right for them. Given that the quality of the average \$700 inkjet printer rivals or may exceed a \$50,000 photo lab printer, the typical inkjet user indeed has a great tool at their disposal.

PRINTER TEST DETAILS - Epson R1900 Photo Black Inks

Paper used: Red River UltraPro Satin

Print stats: 8" x 10" 300ppi

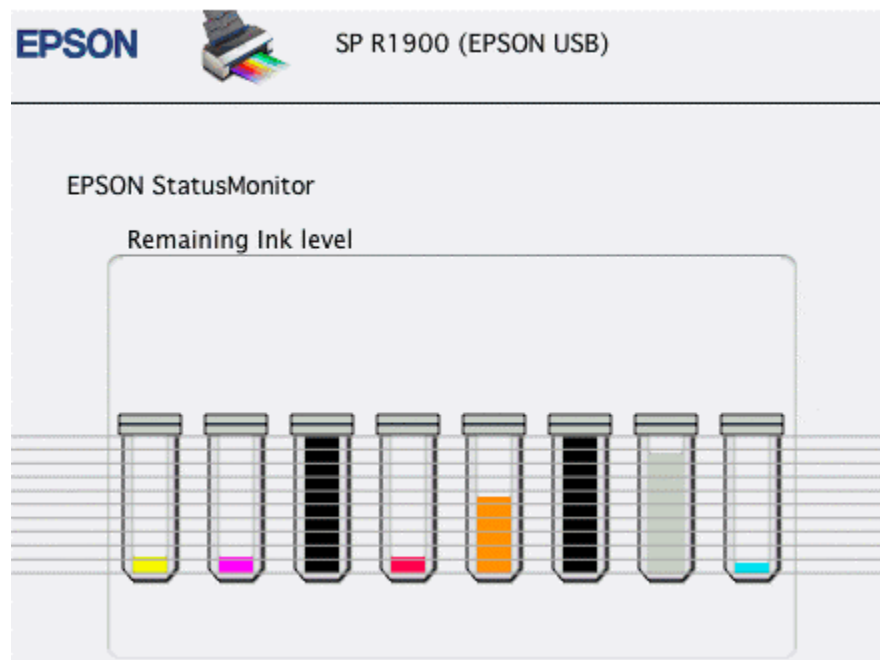
Printer settings: Ultra Premium Photo Paper Luster, Best Photo, High Speed on

Replacement Log

Ink	C	M	Y	PK	MK	O	R	GLOP
Starting	1	1	1	1	1	1	1	1
Replaced	2	1	1	1	0	1	0	0
Used in Remaining Tank	96%	90%	90%	0%	0%	45%	90%	10%
Total usage in %	296%	190%	190%	100%	0%	145%	90%	10%

TOTAL 1020% or the equivalent of 10 ink cartridges

Special Notes: The Used row indicates ink usage of the cartridges in-place at 200th print.



Cartridges replaced = 6

Equivalent remaining cartridges used = 4.2

Total Ink Cartridge Usage for 200 prints = 10.2

.05 cartridges used per 8" x 10" print (.000625 cartridges per sq.inch)

Special Notes:

The R1900 showed no ink usage for Matte Black. The Gloss Optimizer showed about 10% usage. The Photo Black ink was replaced at print 189 and did not show measurable decline before the test was ended.

PRINTER TEST DETAILS - Epson R2400 Photo Black Test

Paper Used: Red River UltraPro Satin

Print stats: 8" x 10" 300ppi

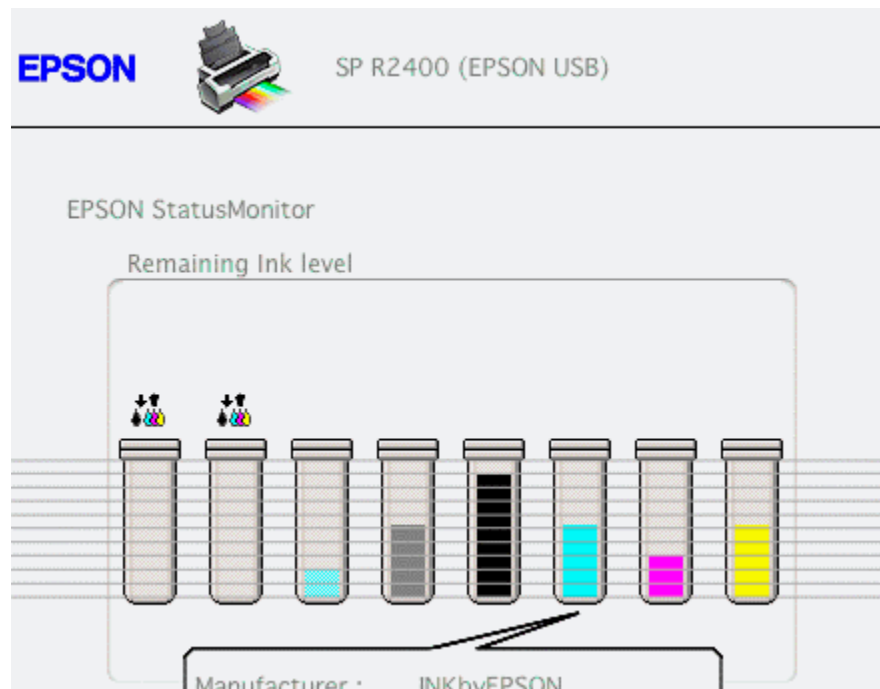
Printer settings: Ultra Premium Photo Paper Luster, Best Photo, High Speed on

Replacement Log

Ink	C	M	Y	PK	LK	LLK	LM	LC
Starting	1	1	1	1	1	1	1	1
Replaced	0	0	1	1	1	2	3	1
Used in Remaining Tank	48%	70%	48%	12%	48%	100%	100%	80%
Total usage in %	48%	70%	148%	112%	148%	300%	400%	180%

TOTAL 1400% or the Equivalent of 14 ink cartridges

Special Notes: The Used row indicates ink usage of the cartridges in-place at 200th print.



Cartridges replaced = 11

Equivalent remaining in cartridges used = 3

Total Ink Cartridge Usage for 200 prints = 14

.07 cartridges used per 8" x 10" (.0009 cartridges per sq. inch)

PRINTER TEST DETAILS - Epson R2400 Matte Black Test

Paper Used: Red River 47lb. Premium Matte

Print stats: 8" x 10" 300ppi

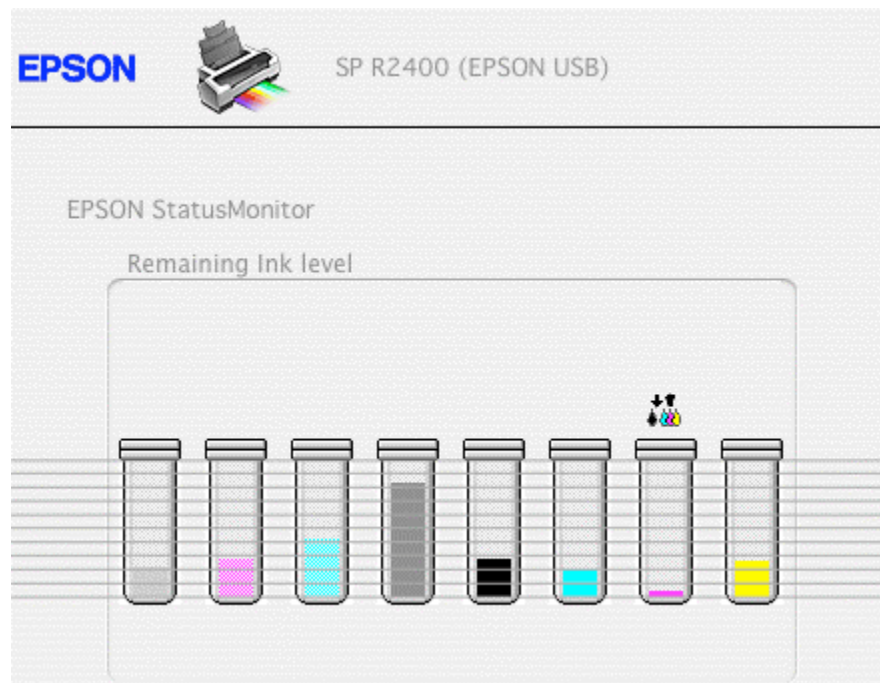
Printer settings: Premium Presentation Paper Matte, Best Photo, High Speed on

Replacement Log

Ink	C	M	Y	MK	LK	LLK	LM	LC
Starting	1	1	1	1	1	1	1	1
Replaced	0	0	2	0	3	0	2	1
Used in Remaining Tank	80%	95%	75%	75%	20%	80%	70%	60%
Total usage in %	80%	95%	175%	75%	220%	80%	270%	160%

TOTAL 1150% or the equivalent of 11.5 ink cartridges

Special Notes: The Used row indicates ink usage of the cartridges in-place at 200th print.



Cartridges replaced = 6

Equivalent remaining in cartridges used = 5.5

Total Ink Cartridge Usage for 200 prints = 11.5

.06 cartridges used per 8" x 10" (.00075 CEU per sq. inch)