In a primitive environment power usage if available becomes critical with respect to efficient lighting for growing. The growing can be hydroponic or in the ground. The light needs to be produced as efficiently as possible from minimal power that is available.

Early research into the subject indicated red and blue LED lighting would work for efficient grow lights. This would mean one would have to buy lots of red and blue LED and build you own or purchase the latter available pre-assembled panels or cluster LED bulbs. Over the last 10 years or so this has been expensive on a per watt cost basis. The Blue LED would only last a few months of full time use before falling below half the original light output.

In March 2010 with ebay prices on mono color LEDs at a low price of about $.50 per watt for large quantities of 3mm round superbright LEDs of different colors. We did some testing to see how long they would last. Testing was done at 25ma, 19ma and 12ma over 141 days or 3,384 hours. The following table indicates the specifications for these LEDs.

Round LED

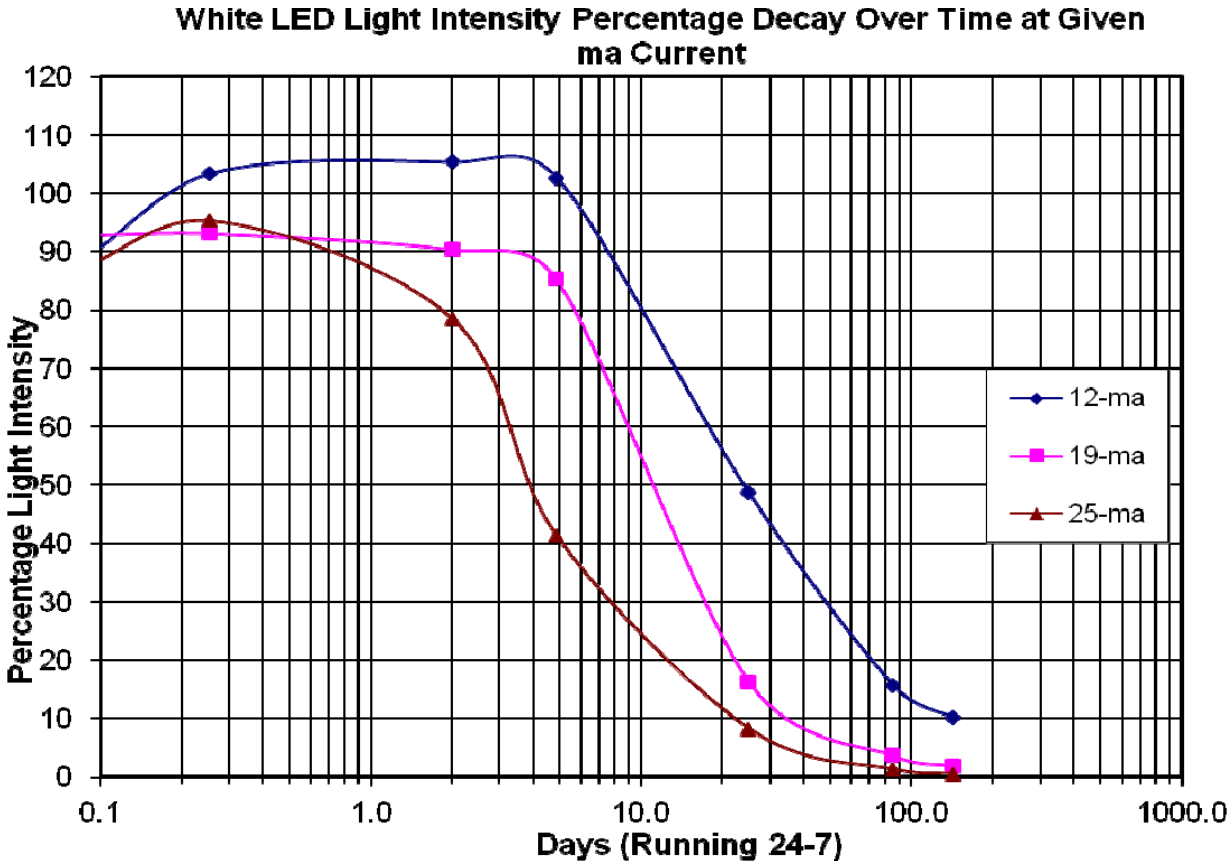
	Forward Voltage(V) If=25mA		Dominant wavelength(mm) If=25mA		MCD If=25mA		Reverse current(uA) Vr=5V	50% Power Angle (deg)
	Min	Typ	Min	Typ	Min	Typ	Max	
Red	1.8	2	615	625	8000	10000	10	40
Yellow	1.8	2.2	587	595	4000	5000	10	40
Bright Green	3	3.2	515	520	12000	14000	10	40
Blue	3	3.2	460	465	5000	6000	10	40
White	3	3.2		N/A	16000	20000	10	40
Warm White	3.2	3.5		N/A	13000	14000	10	40
Pink	3	3.5		N/A	8000	9000	10	40
UltraVolet/ purple	3	3.2	390	400	1000	1200	10	40
Orange/Amber	2	2.2	515	520	5000	6000	10	40

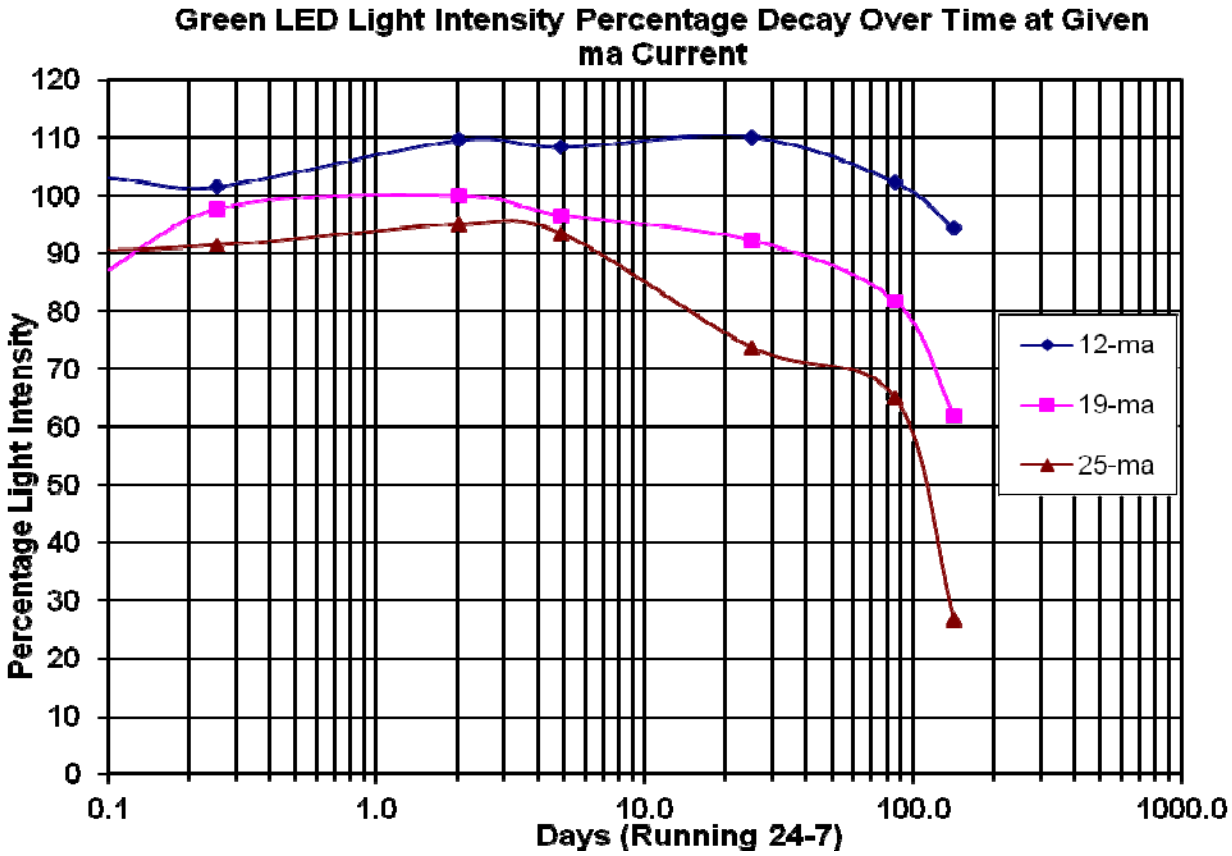
The curves below indicate the resulting intensity drop over time. Notice that white, violet and blue falls off in light intensity rapidly with time. These are a waste of money to use for grow lighting. Red, orange and yellow do not fall off enough to measure and are

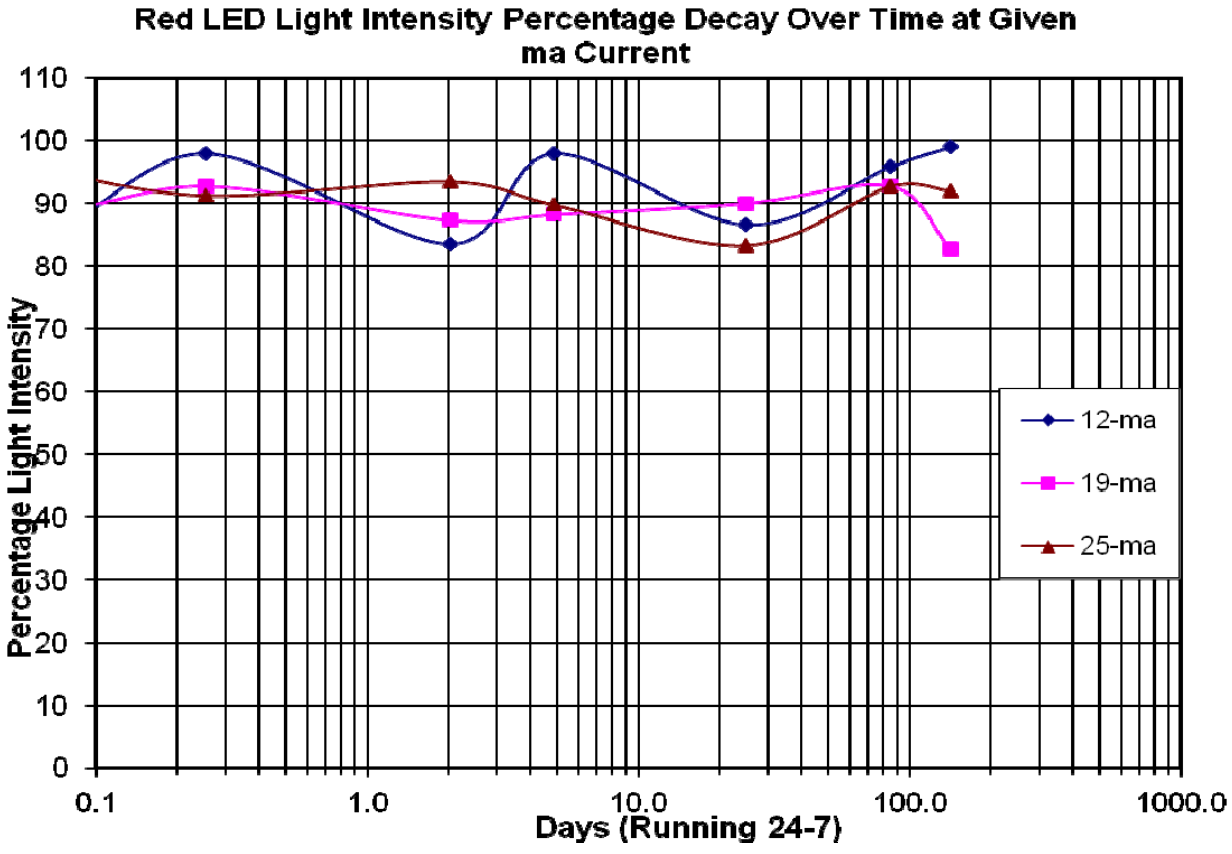
recommend for use in grow lighting. Green falls off slower than white, violet, and blue. Green is not usefully for grow lights because it is a reflected color by plants. Note also that green and white give much higher Lux intensities than any of the rest.

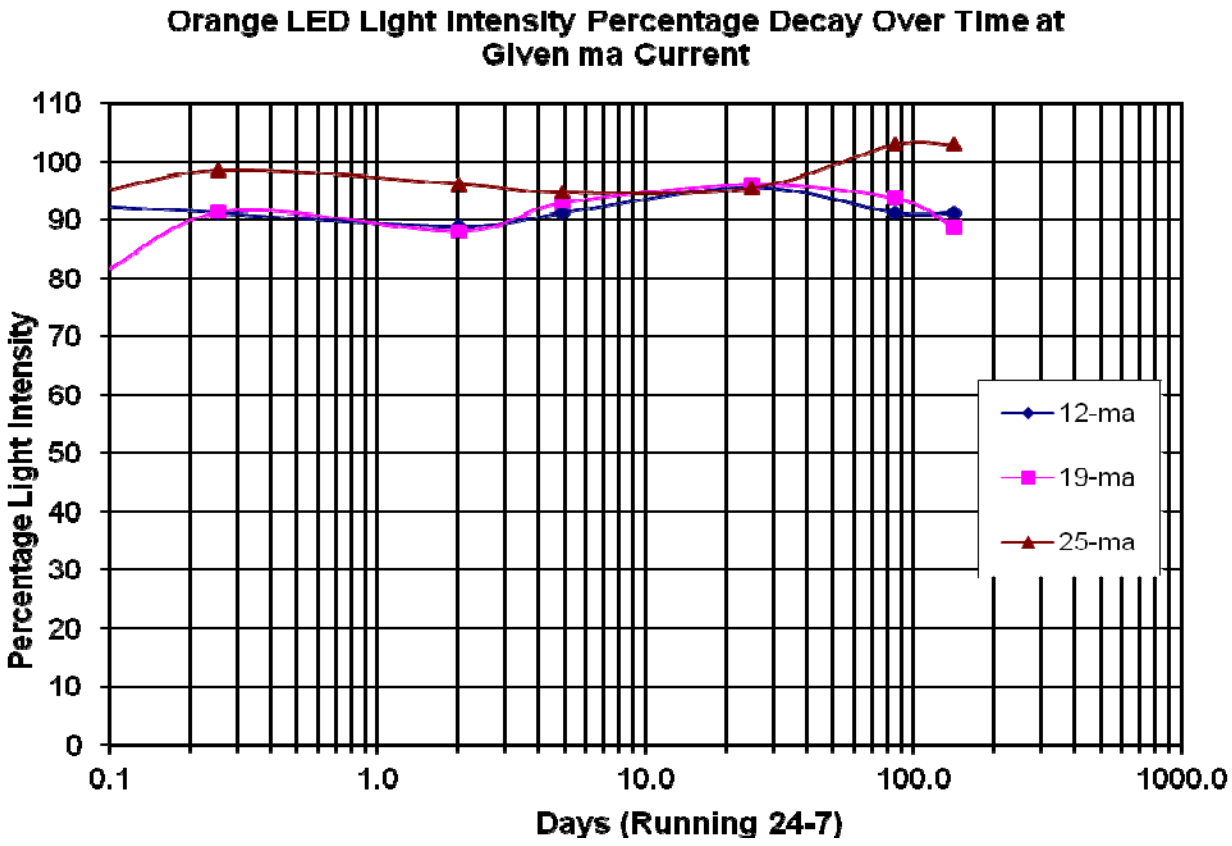
If 50% of original intensity is used as a criteria for usefully life span for a LED then

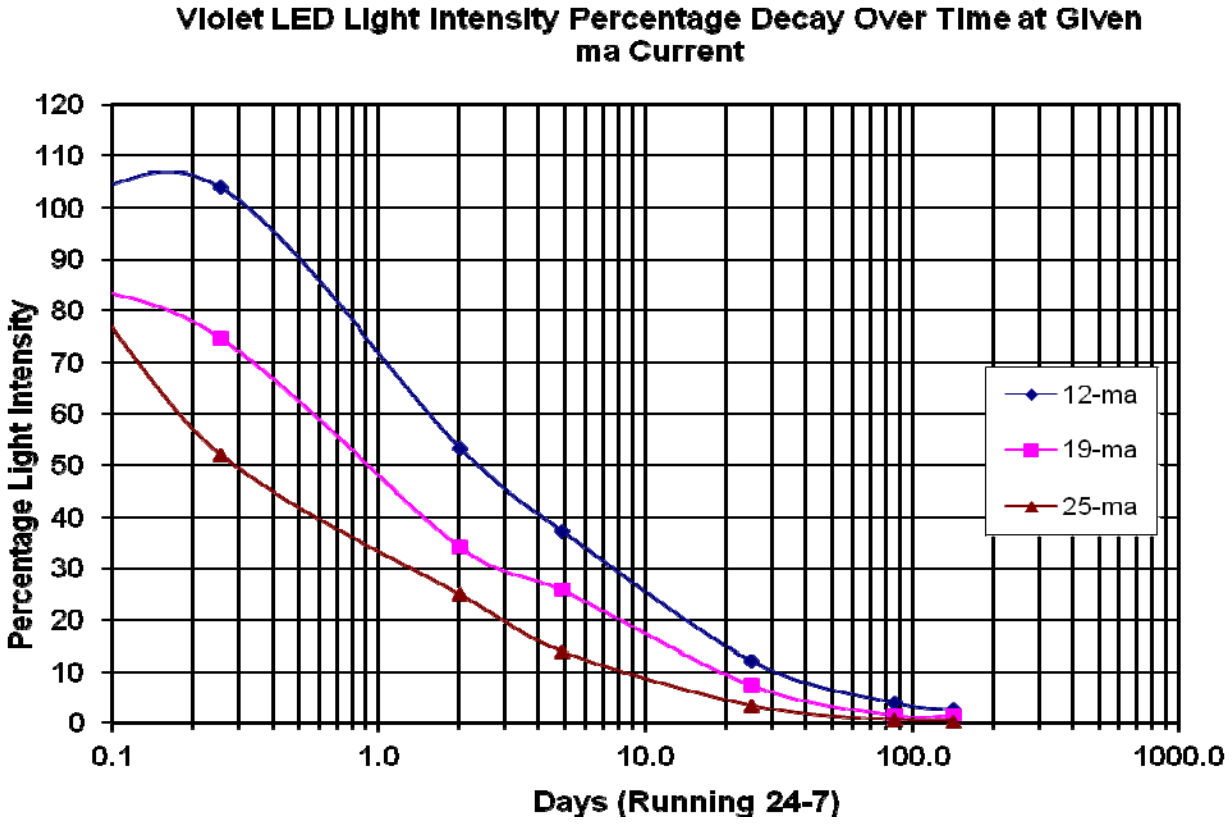
Usefull life time in Days	25-ma	19-ma	12-ma	12-ma/25-ma ratio
White	3	12	24	8.00
Violet	0.3	0.9	2.4	8.00
Blue	15	15	47	3.13
Green	120	?	?	

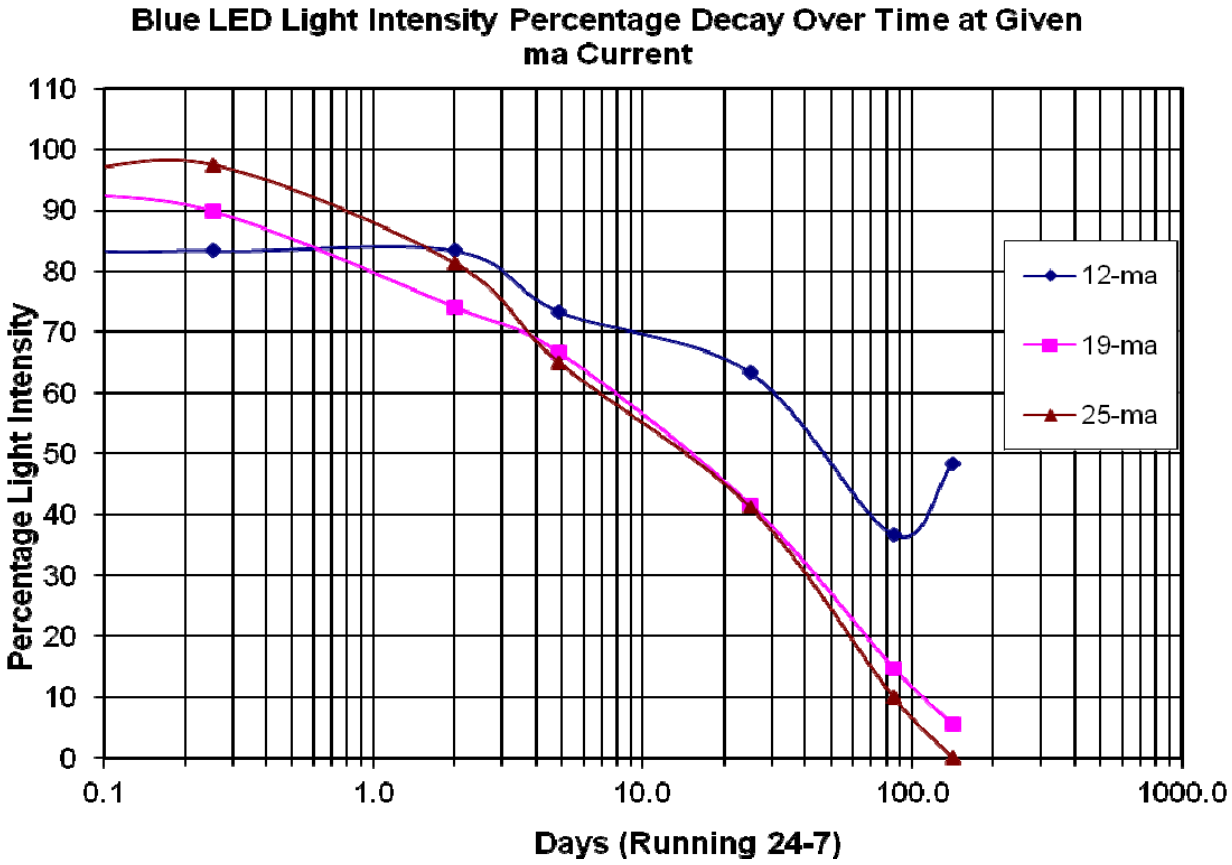


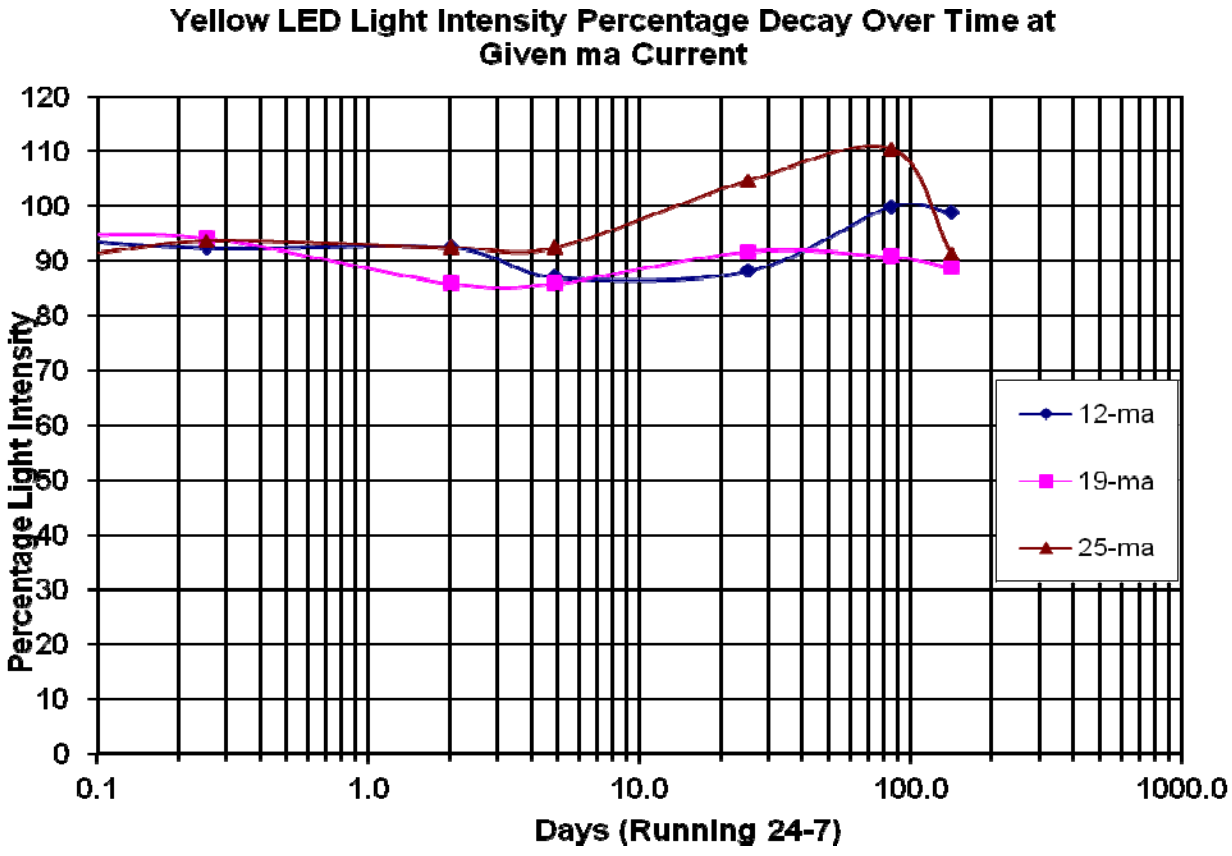

Green LED Light Intensity Percentage Decay Over Time at Given ma Current
Percentage Light Intensity
120
110
100
90
80
70
60
50
40
30
20
10
0
0.1
1.0
10.0
100.0
1000.0
Days (Running 24-7)
12-ma
19-ma
25-ma

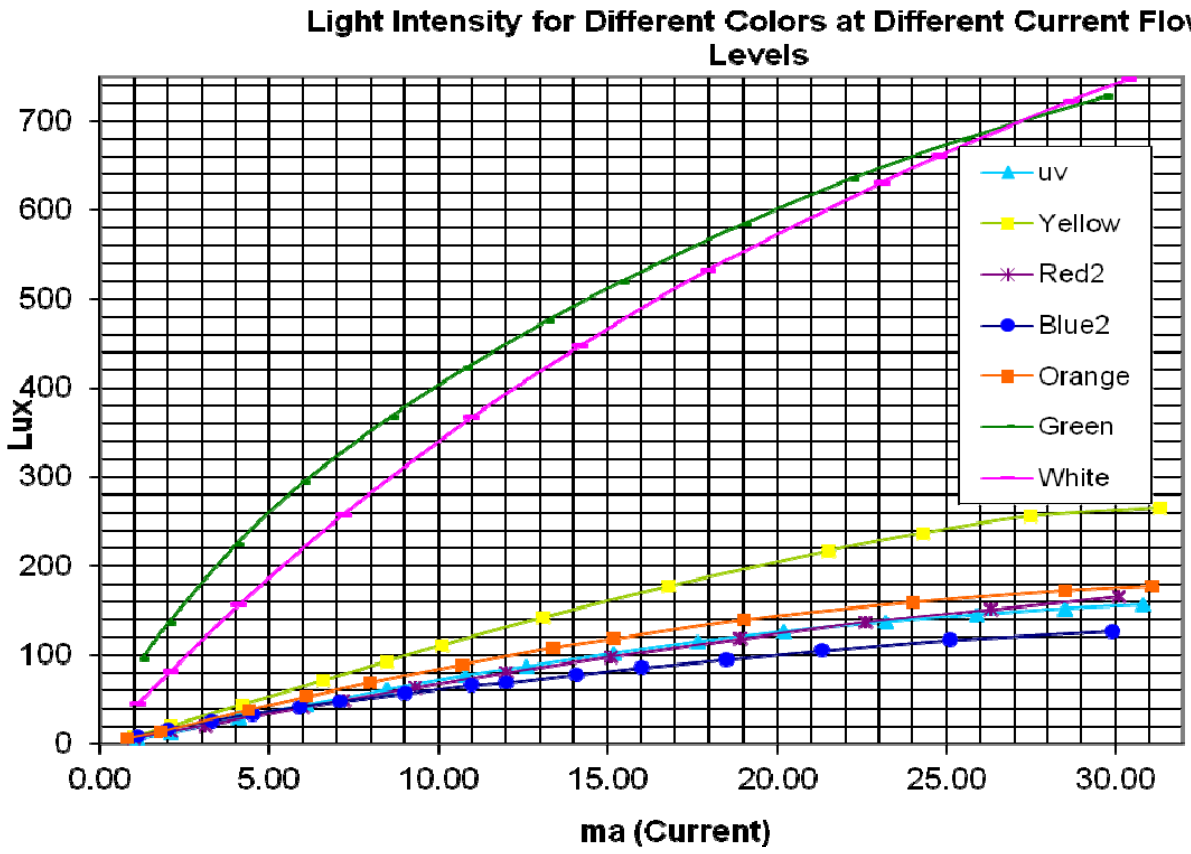

Red LED Light Intensity Percentage Decay Over Time at Given ma Current
Percentage Light Intensity
110
100
90
80
70
60
50
40
30
20
10
0
0.1
1.0
10.0
100.0
1000.0
Days (Running 24-7)
12-ma
19-ma
25-ma

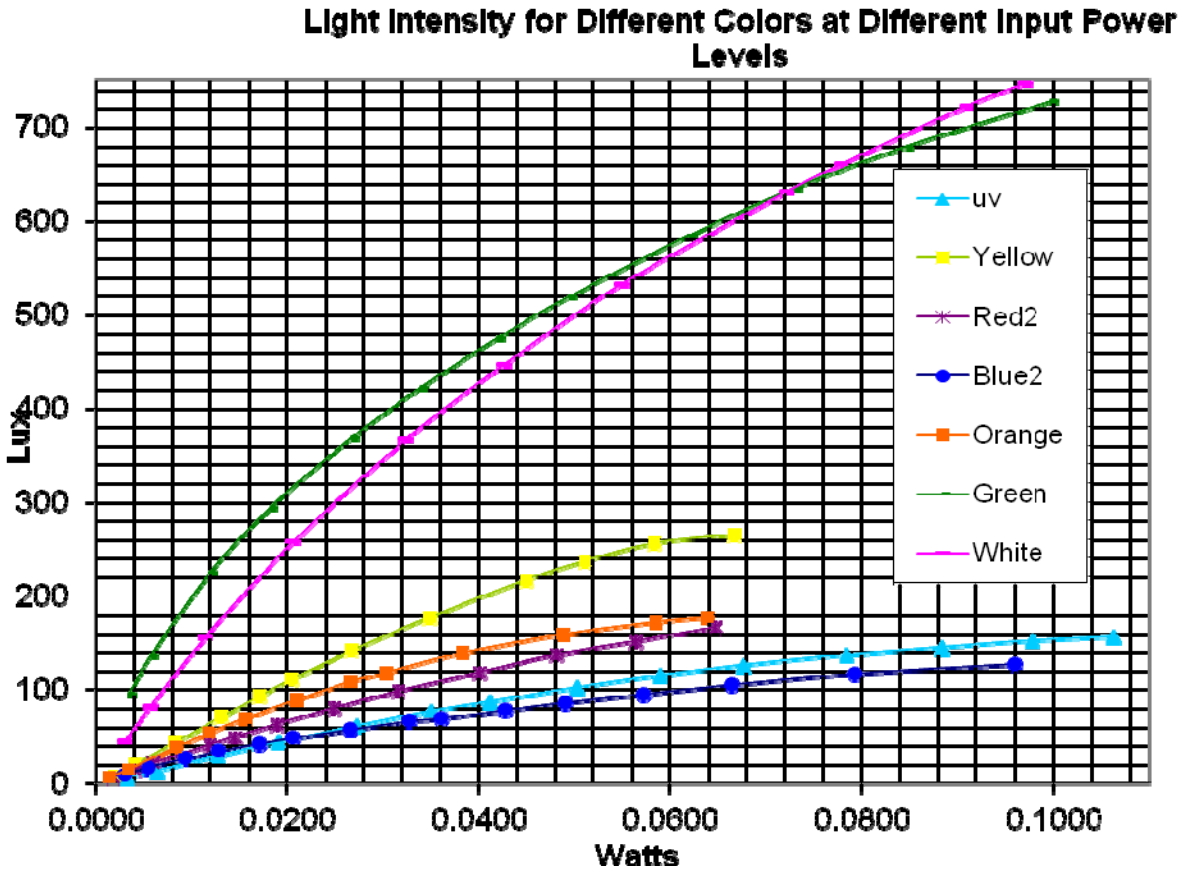

Orange LED Light Intensity Percentage Decay Over Time at Given ma Current
Percentage Light Intensity
110
100
90
80
70
60
50
40
30
20
10
0
0.1
1.0
10.0
100.0
1000.0
Days (Running 24-7)
12-ma
19-ma
25-ma


Violet LED Light Intensity Percentage Decay Over Time at Given ma Current
Percentage Light Intensity
120
110
100
90
80
70
60
50
40
30
20
10
0
0.1
1.0
10.0
100.0
1000.0
Days (Running 24-7)
12-ma
19-ma
25-ma


Blue LED Light Intensity Percentage Decay Over Time at Given ma Current
Percentage Light Intensity
110
100
90
80
70
60
50
40
30
20
10
0
0.1
1.0
10.0
100.0
1000.0
Days (Running 24-7)
12-ma
19-ma
25-ma


Yellow LED Light Intensity Percentage Decay Over Time at Given ma Current
Percentage Light Intensity
120
110
100
90
80
70
60
50
40
30
20
10
0
0.1
1.0
10.0
100.0
1000.0
Days (Running 24-7)
12-ma
19-ma
25-ma

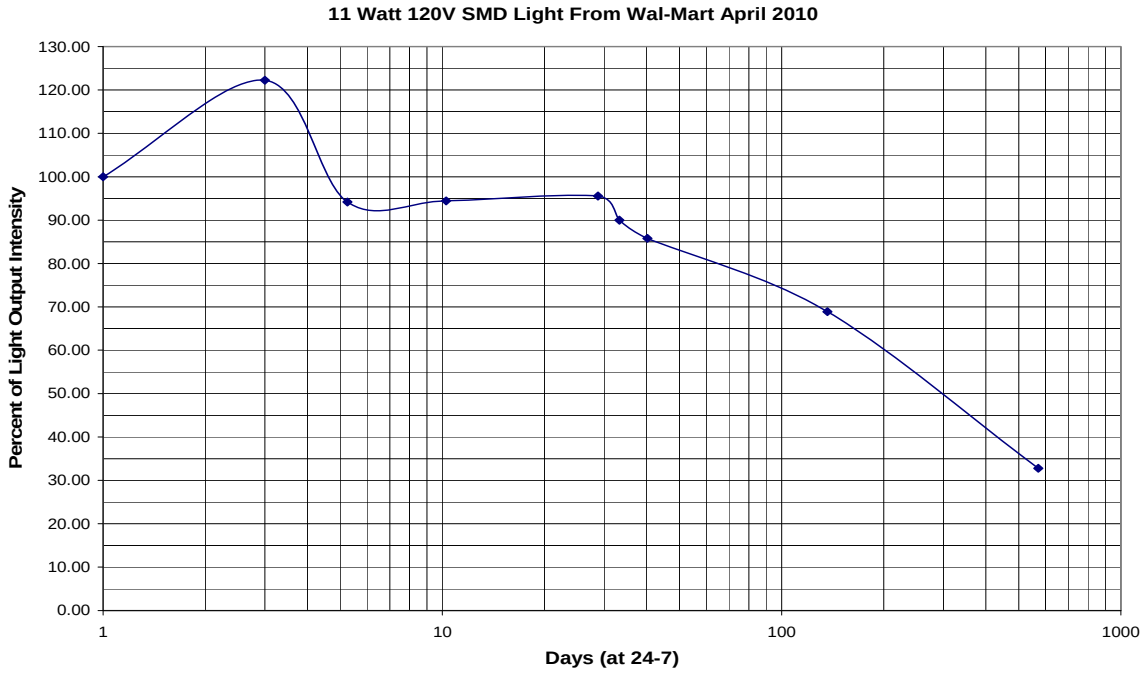

Light Intensity for Different Colors at Different Current Flow Levels
700
600
500
400
300
200
100
0
Lux
0.00
5.00
10.00
15.00
20.00
25.00
30.00
ma (Current)
uv
Yellow
Red2
Blue2
Orange
Green
White

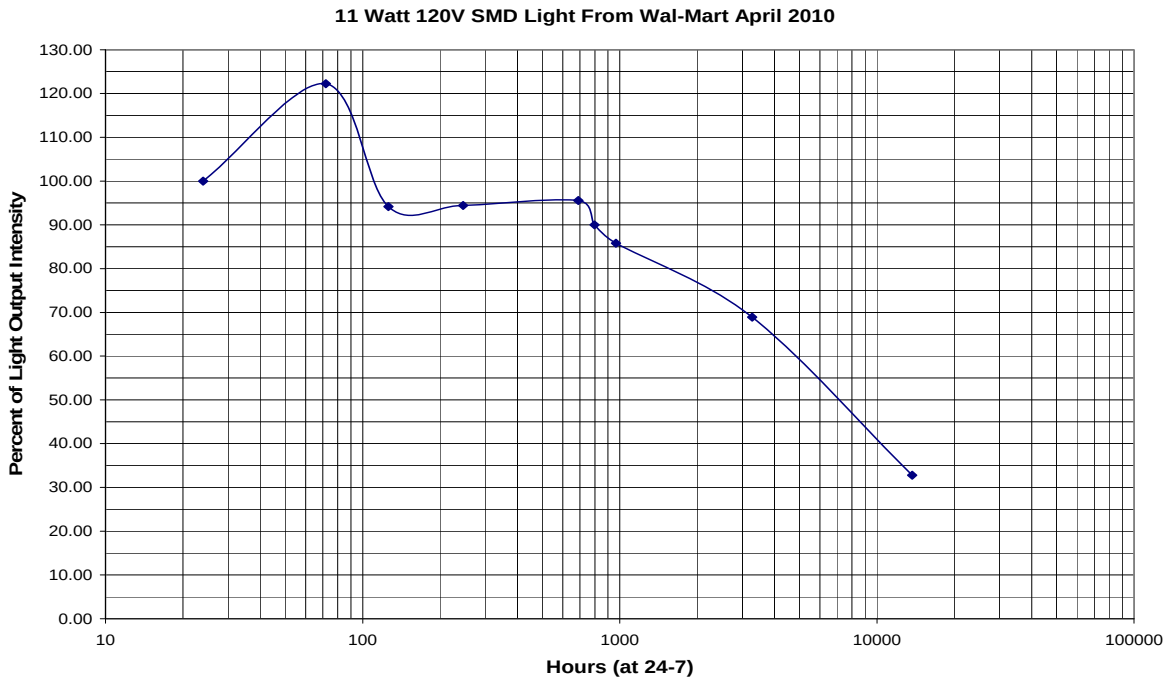

Light Intensity for Different Colors at Different Input Power Levels
700
600
500
400
300
200
100
0
Lux
0.0000
0.0200
0.0400
0.0600
0.0800
0.1000
Watts
uv
Yellow
Red2
Blue2
Orange
Green
White

Bottom line for the above: 3mm, 5mm, or 10mm clear epoxy based LEDs are not the best way to go when building a grow lighting system. Not long lasting and assembly of the large number of Leds needed becomes prohitivie.

Only recently has the technology of LEDs progressed to the white SMDs that are advertised to last 50k hours.

SMD stands for surface mount device. SMD-LEDs build up much less heat and as a result last signaficanly longer. My peliminalry testing with white SMD-LEDs is shown in the following two graphs at full power 120AC.





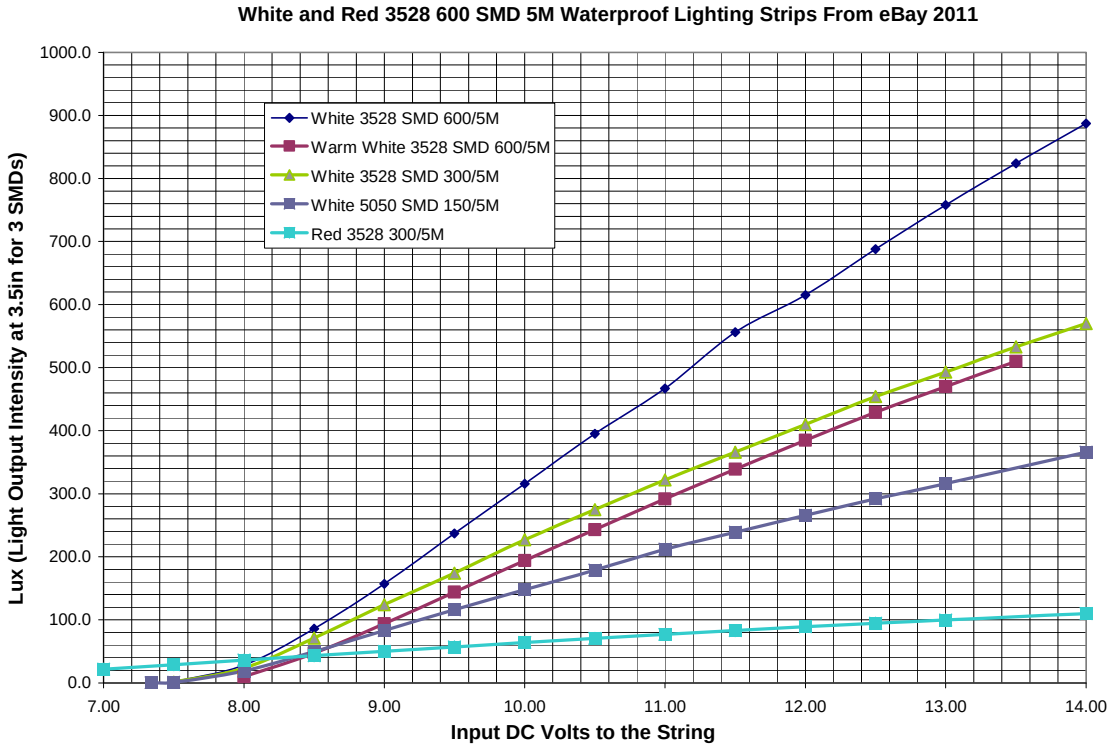
When the effective lifetime (intensity drops to 50%) is compaired between SMD-LEDs and discrete 3mm clear epoxy type LEDs at full current rating we get 7000 hrs (300 days) for SMDs and 72 hrs (3 days) for 3mm white LEDs. This indicates SMDs are 100 times better in terms of usefull lifetime. Running at half current then one would expect the usefull life time to be extended to say 4 to 8 times 300 days. This white SMD-LED then becomes possible to use for grow lighting.

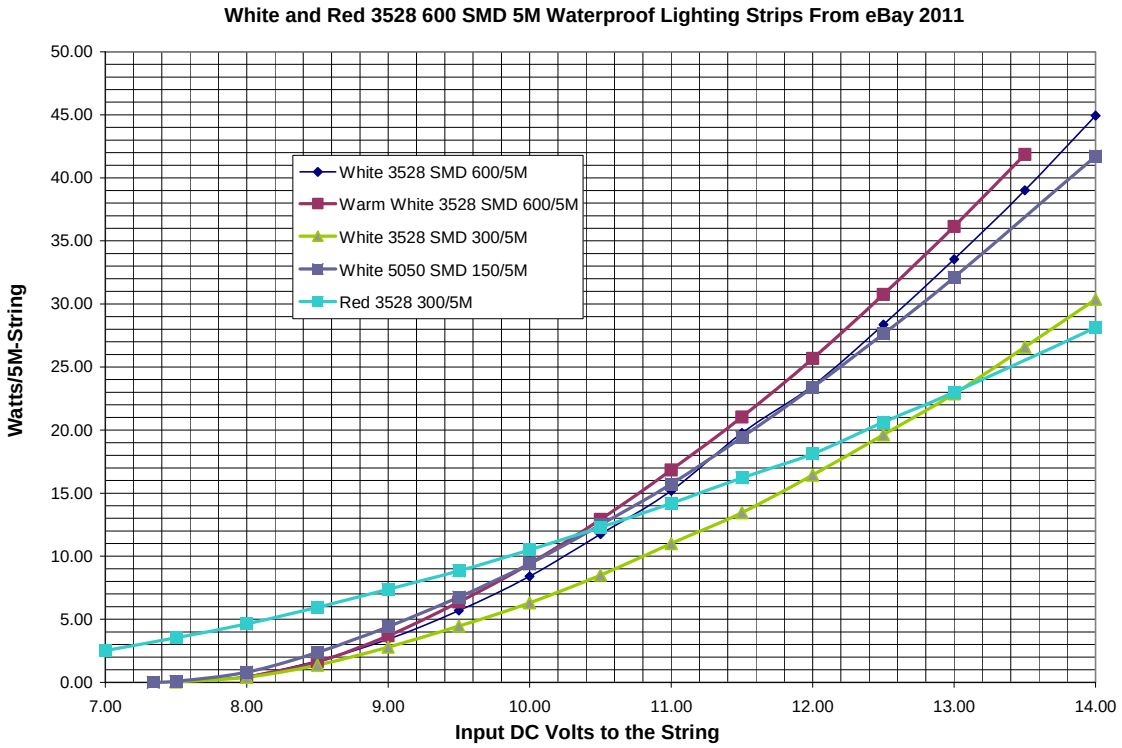
The next inovation for practial grow lighiting is the appearnce on the market of 12 volt 5M spools of flexable strip SMD-LED waterproof lighting. These can be cut to size if needed and have sticky tape backing so as to be able to tape the string to a solid serface. The could be a strip of tin roofing that is possitioned at different height depending on height of the plant growth.

These can currently be found on ebay in all colors and in varing lenghts with 150, 300, or 600 SMDs per meter. The black box on the left is dimmer that can be used to effiently lower the voltage. As of Nov-Dec 2011 the best prices were found by compairing the

results of each of the following text serach strings. “white SMD 5M 600 Waterproof -non-Waterproof” “white SMD 5M 300 Waterproof -non-Waterproof”. Change the color from white to yellow, Red, orange, amber, blue as needed.

At this time Jan 2012 I have found white and 600 SMDs/5M strip lighting to be the most cost efficient when the light output/watt is measured divided by cost. I don’t recommend using blue, use mostly white instead and maybe a bit of red. The red is well below the light output of the white at this time and is not very efficient at producing light. Red may last longer than the white. However, even if white drops to half output it still measures to have more lumen output than the red. The way these strings are implemented with 3 red or white per 12v it is inefficient to use red. If 5 or 6 red were used per 12 volts it might be different story. But for now if grow lighting is to be made stay with white.





If you have 12 volt battery power use this for driving your SMD LED Strip Lighting. Several dimmers are avalable serach for “12V dc dimmer strip”. I have found the one pictured above to be the better one to use. It also comes with a remote control.

For a dc power supply that will convert AC to DC and drive these smd strip lights serach on ebay for “12V dc power supply strip” and look for more power or current than you will need. The more cost effective ones are at the 10, 15, 20, 30 amp range. The ones that have a switch for 115 to 220 volts work better than the ones that don’t have a switch when using 115 volts. These units will not produce the proper voltage when running near max rated current. Purchase and test before buying lots of them.

Summary: Sodum vapor lighting would be our second choice for growing. 12 V DC 5 meter SMD strip lighing would be first choice under the current humand technological avalabiliy.