



FERTILIZER & CHEMICAL INPUTS FOR HEALTHY TURF



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SKY72 Golf Resorts - Korea

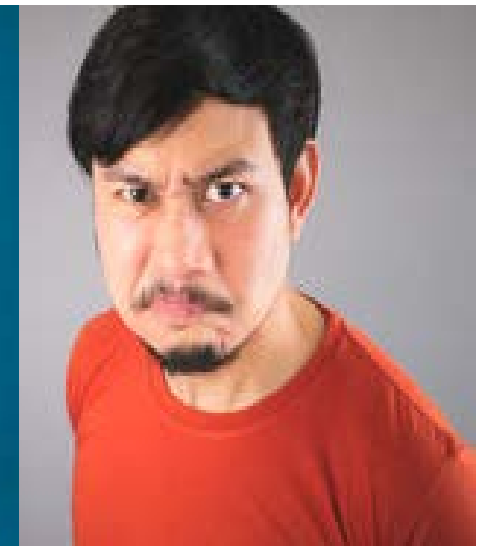
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WE HAVE A SERIOUS “**COST**” PROBLEM IN GOLF !!!

- 1. Golf is too expensive and superintendents are much to blame! WHY?**
- 2. From my experience and observations I have found that 75 – 80% of Golf Course Superintendents world-wide are weak to extremely weak in skill levels to calculate their comparative fertilizer / chemical use accurately.**





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- 2. From my experience and observations I have found that 75 – 80% of Golf Course Superintendents world-wide are weak to extremely weak in skill levels to calculate their comparative fertilizer / chemical use accurately.***
- 3. LET’S GET REAL! If you can’t calculate your actual use accurately in a standard format, you will be completely lost when it comes to:***
 - A. COMPARATIVE Cost Use Analysis***
 - B. COMPARATIVE Material Efficacy***
- 4. What skills do **YOU** need to have or to gain intelligent competence ?***



SKILLS YOU NEED TO HAVE OR NEED TO GAIN

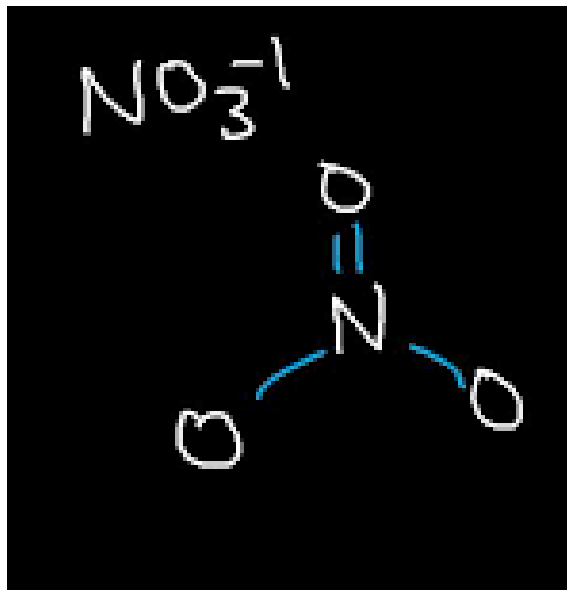


- 1. You must be able to do elementary mathematic calculations with understanding of some simple Algebra / Geometry.***



SKILLS YOU NEED TO HAVE OR NEED TO GAIN

1. You must be able to do elementary mathematic calculations with understanding of some simple Algebra / Geometry.
2. You need at least a high school level understanding of simple Chemistry.



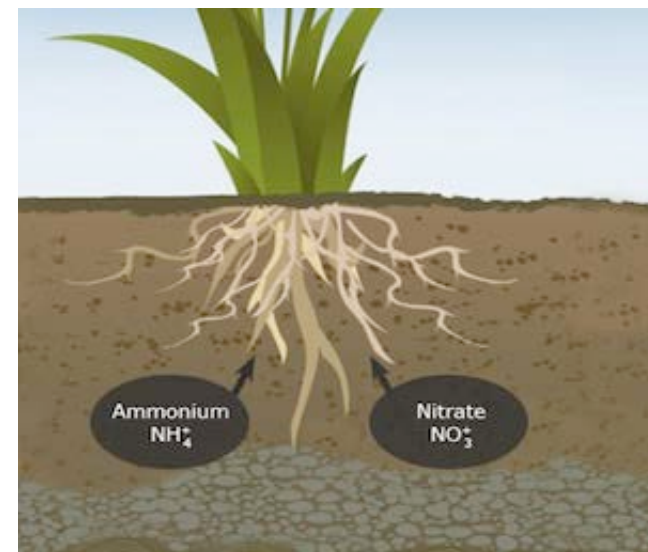
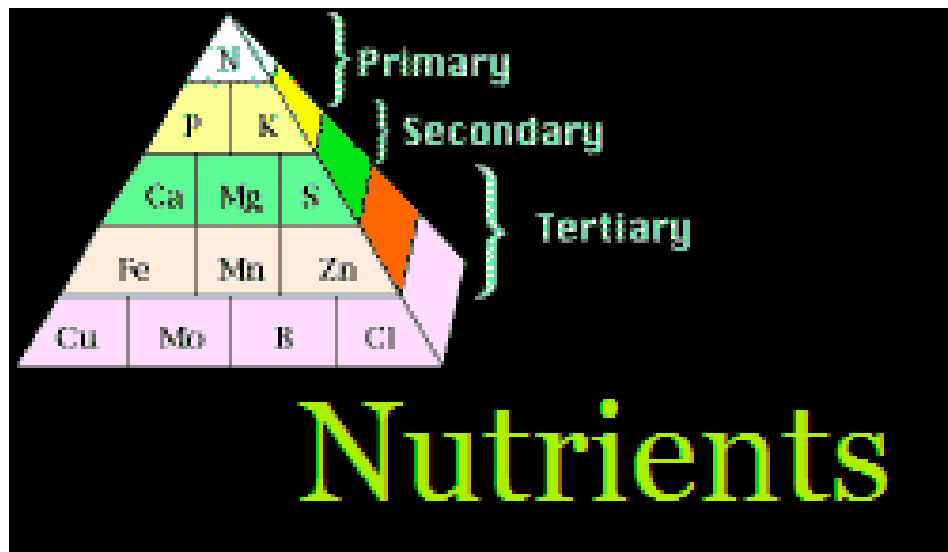
Periodic Table of the Elements

1 IA 1A		2 IIA 2A		3-10 IIIB 3B IVB 4B VB 5B VIB 6B VIIA 7A VIII 8 9 10 IB 1B IIB 2B										11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A								
1 H Hydrogen 1.008		2 He Helium 4.003												3 Li Lithium 6.941	4 Be Beryllium 9.012	5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 16.000	9 F Fluorine 18.998	10 Ne Neon 20.180								
11 Na Sodium 22.990		12 Mg Magnesium 24.305												13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948										
19 K Potassium 39.098		20 Ca Calcium 40.078												21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.63	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.468		38 Sr Strontium 87.62												39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.905	54 Xe Xenon 131.29
55 Cs Cesium 132.905		56 Ba Barium 137.327												57 La Lanthanum 138.905	58 Ce Cerium 140.12	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.255	69 Tm Thulium 168.934	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.967	
87 Fr Francium 223.021		88 Ra Radium 226.025												89-103 Lanthanide Series	104 Rf Rutherfordium 261	105 Db Dubnium 262	106 Sg Seaborgium 263	107 Bh Bohrium 264	108 Hs Hassium 265	109 Mt Meitnerium 266	110 Ds Darmstadtium 267	111 Rg Roentgenium 268	112 Cn Copernicium 269	113 Uut Ununtrium 270	114 Fl Flerovium 271	115 Uup Ununpentium 272	116 Lv Livermorium 273	117 Uus Ununseptium 274	118 Uuo Ununoctium 275
89 Ac Actinium 227.028		90 Th Thorium 232.038												91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium 252.083	100 Fm Fermium 257.095	101 Md Mendelevium 258.10	102 No Nobelium 259.101	103 Lr Lawrencium 262			
Alkali Metal		Alkaline Earth		Transition Metal										Basic Metal		Semimetal		Nonmetal		Halogen		Noble Gas		Lanthanide		Actinide			

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SKILLS YOU NEED TO HAVE OR NEED TO GAIN

- 1. You must be able to do elementary mathematic calculations with understanding of some simple Algebra / Geometry.***
- 2. You need at least a high school level understanding of simple Chemistry.***
- 3. You need a must have, basic understanding of plant nutrient requirements – MORE THAN ‘SIMPLISTIC.’***





SKILLS YOU NEED TO HAVE OR NEED TO GAIN



- 1. You must be able to do elementary mathematic calculations with understanding of some simple Algebra / Geometry.***
- 2. You need at least a high school level understanding of simple Chemistry.***
- 3. You need a must have, basic understanding of plant nutrient requirements – MORE THAN ‘SIMPLISTIC.’***
- 4. You need some basic Accounting and record keeping / clerical skills – and be subject to auditing.***
- 5. You need to be able to layout ‘must do’ test / demonstration plots on your golf course to show golfers, boss, staff & YOURSELF!***
- 6. You need to know as much or more than sales people!***
- 7. You need to be able to explain and PROVE your use.***



STANDARDS & FUNDAMENTALS



1. To do meaningful cost comparisons as in Agriculture we use ***TURFGRASS INDUSTRY STANDARDS*** for measuring.
2. Throughout Asia our standard measurement of fertilizer and chemical applications are recorded as: ***grams (or milliliters) per square meter*** (i.e. 1.0g / m²)
3. In North America the standard measurement is recorded as: ***pounds per 1,000 square feet*** (i.e. 0.25 lbs. / 1000 ft²)

In Asia you must know how to **CONVERT** back and forth to compare **PESTICIDE LABELS** and **FERTILIZER APPLICATION RATES**:



STANDARDS & FUNDAMENTALS



Make a simple conversion calculator in an Excel spreadsheet:

Pounds per Kft ² to Metric			
:			
0.25			
Metric to Pounds per Kft ²			
1.00			

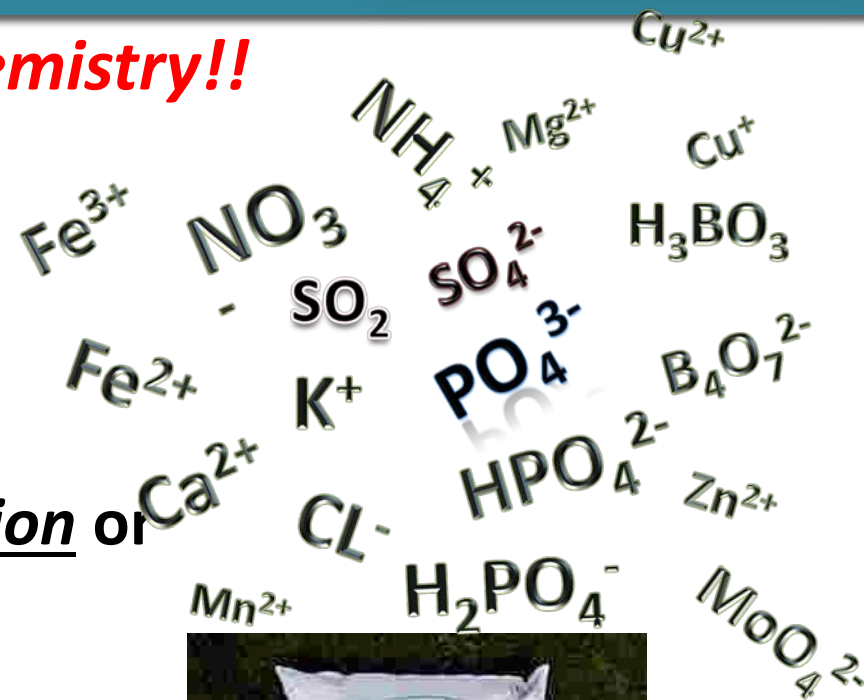
[Excel FILE LINK](#)

STANDARDS & FUNDAMENTALS

Oh, that Basic Chemistry!!

1. You must know FERTILIZER FUNDAMENTALS and the chemical structure of the 'ACTUAL' NUTRIENT MOLECULE that the turfgrass PLANT uptakes each AVAILABLE nutrient cation or anion.

2. These are defined LEGALLY in FERTILIZER STANDARDS CODES to determine both our application rates and financial calculations.



% by
Weight

MATERIAL and SUPPLY Costs - Testing

KNOWING “ACTIVE INGREDIENTS”

₱ 10,000

2.0 L



10%

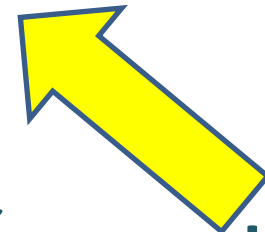
≠

₱ 15,000

2.0 L



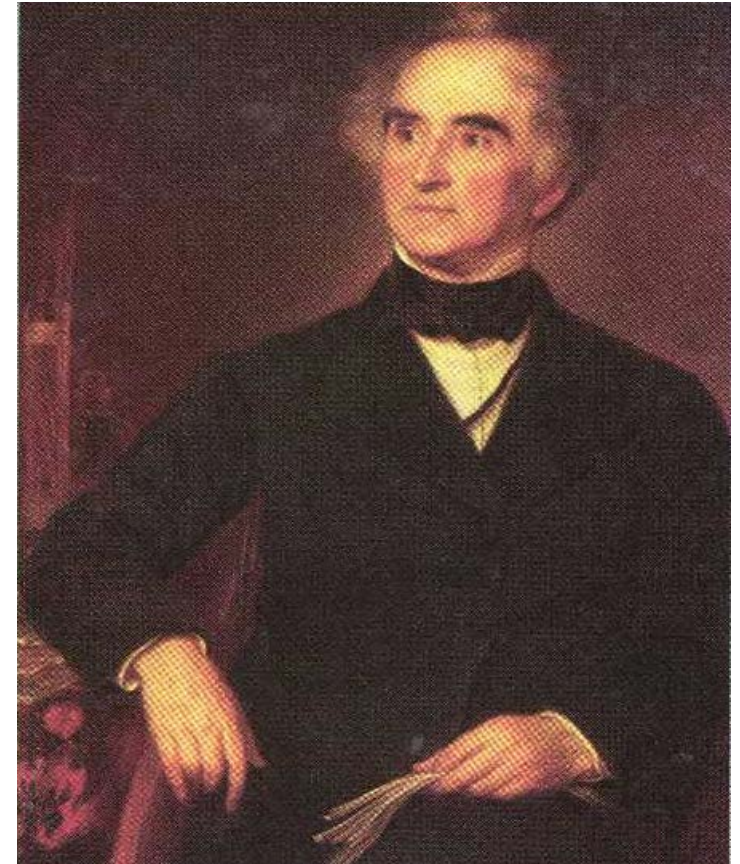
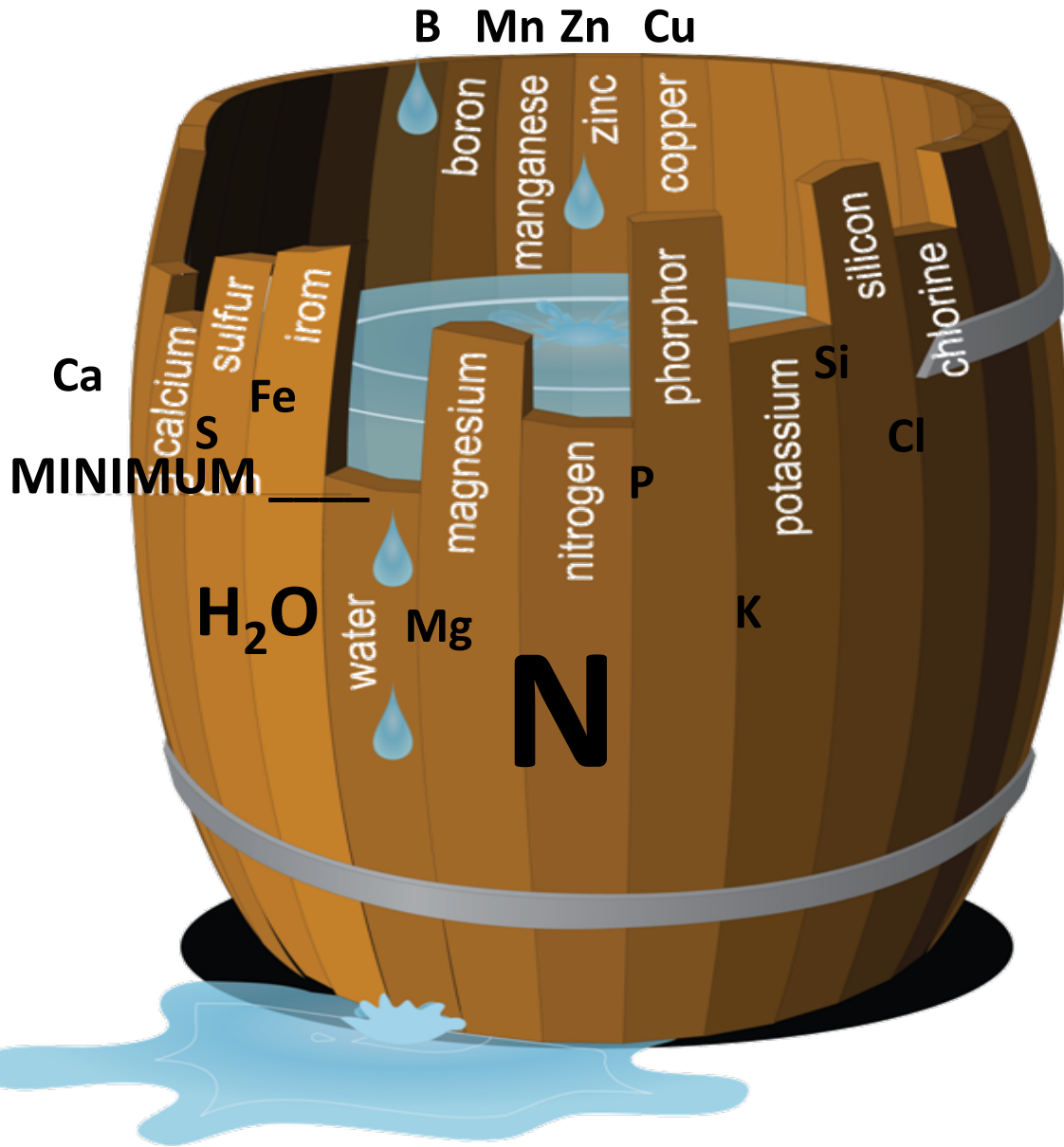
90%



LEAST EXPENSIVE

CALCULATE COST ‘ACTIVE INGREDIENT’ / ml

Law of Minimum



Justus von Liebig

1803 -1873

MATERIAL and SUPPLY Costs - Testing

KNOWING “POUR COST” and “APPLICATION COST” – SIMILAR

?



?



?



?



?



MATERIAL and SUPPLY

Costs - Testing



SKY72 - Zoysia Material Evaluation Plot Plan

1.011 Varieties to be included in the Material Evaluation Agreement will include:

- 1.011.1 - Zeon* need 20 sq feet using 12" x12" format
- 1.011.2 - LIF
- 1.011.3 - M-66
- 1.011.4 - M-24
- 1.011.5 - 29-2-B7
- 1.011.6 - 662
- 1.011.7 - M-45
- 1.011.8 - DR-39
- 1.011.9 - 29-2-B23
- 1.011.10 - 29-2-B9
- 1.011.11 - M-85
- 1.011.12 - Y-2
- 1.011.13 - TDI2013 (this will ship from Oregon)
- 1.011.14 - M-60

18 individual material plots replicated X 3 = 54 total study plots.

- Each plot shall be 1 meter by 1 meter (square). All plots will be separated by 30 cm of bare ground areas on all sides.
- This plot plan will be installed in three Ocean Course locations: (1) OC Greenhouse; (2) OC #1 PG - south face; (3) OC LPGA Range - north face.

1. Zeon (nodded)	2. LIF	3. M-66	4. M-24	5. 29-2-B7	6. 662	7. M-45	8. DR-39	9. 29-2-B23	10. 29-2-B9	11. M-85	12. Zeon (plugged)	13. Y-2	14. TDI 2013
15. 16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	
M-60	BLANK	BLANK	BLANK	Zeon (sprigged)	DR-39	29-2-B9	Y-2	M-24	Zeon (nodded)	M-66	662	LIF	29-2-B23
29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.
M-85	Zeon (nodded)	TDI 2013	M-45	29-2-B7	BLANK	Zeon (sprigged)	BLANK	M-60	M-66	29-2-B7	Zeon (nodded)	BLANK	DR-39
43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.	55.	56.
BLANK	662	Y-2	M-85	Zeon (sprigged)	LIF	BLANK	29-2-B9	M-45	TDI 2013	29-2-B23	M-24	M-60	Zeon (plugged)

We have added Myers as an index due to its known cold tolerance trait. Bent grass and Kentucky Bluegrass (K.B.) are added for exacting green-up comparison and evaluation of any encroachments. Plots are all to be well maintained at all times. After spring green-up in 2015 all plots will be moved with two (2) heights of cut (HOC).

- FIRST Step in costing things is to know what you really need:

T - E - S - T

- EVERY Greenkeeper should establish TRIAL TEST EVALUATION plots for fertilizer and grasses.
- When developing a golf course first plant grass test plots for grasses you are considering. Test varieties perpetually!



MATERIAL and SUPPLY

Costs - Testing

Do you really need what is in all those bags? *Likely not!*



- EVALUATE fertilizer perpetually!
- In conjunction with laboratory soil and water testing, confirms best fertilizers for your specific site!

REQUIRED NUTRIENT ELEMENT	PERCENTAGE BY DRY WEIGHT
Carbon (C)	44%
Oxygen (O ₂)	44%
Hydrogen (H)	5.5%
Nitrogen (N)	3 - 6.5%
Potassium (K)	2 - 4%
Phosphorus (K)	0.4 - 0.8%
Sulfur (S)	0.3 - 0.7%
Calcium (Ca)	0.3 - 0.6%
Iron (Fe)	0.1 - 0.3%
Magnesium (Mg)	0.1 - 0.2%
Manganese (Mn); Zinc (Zn) Copper (Cu); Molybdenum (Mo) Boron (B); Chlorine (Cl)	TRACE AMOUNTS FOUND

Fig. 2: Nutrient Composition of Turfgrass by Elemental Dry Weight Percentage



SETTING UP YOUR TEST PLOTS



TREATMENT:	Fertilizer 1	No Treatment - Check	Fertilizer 2	No Treatment - Check	Fertilizer 3
No treatment - Check					
Fertilizer 2					
No treatment - Check					
Fertilizer 3					
Fertilizer 1					

Doing your own quick application test plots is also a good, old-fashioned soil test. It also cuts to the quick on how any particular fertilizer formulation will work in the complexity of your own golf course location! (I.E. Harding Park GC)



Disease Fertilizer Trial Plots
 (200 nitrogen-fertilizers applied at 0.75 grams N / m²)
 All plots are 1 meter by 1 meter
 100 separate plot combinations

Plot #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28	
29	30	31	32	33	34	35	36	37	38	39	40	41	42	
43	44	45	46	47	48	49	50	51	52	53	54	55	56	
57	58	59	60	61	62	63	64	65	66	67	68	69	70	
71	72	73	74	75	76	77	78	79	80	81	82	83	84	
85	86	87	88	89	90	91	92	93	94	95	96	97	98	
99	100	101	102	103	104	105	106	107	108	109	110	111	112	
113	114	115	116	117	118	119	120	121	122	123	124	125	126	
127	128	129	130	131	132	133	134	135	136	137	138	139	140	
141	142	143	144	145	146	147	148	149	150	151	152	153	154	
155	156	157	158	159	160	161	162	163	164	165	166	167	168	
169	170	171	172	173	174	175	176	177	178	179	180	181	182	
183	184	185	186	187	188	189	190	191	192	193	194	195	196	

Plot length = 20 m² N = 0.75 grams per m² = 21.0 grams of actual N needed maximum

Amount of nitrogen fertilizer product		Amount of other products needed	
Calcium Sulfate	120 grams	Magnesium Sulfate	20 grams 30 grams
Silica	40.0 grams	Iron Sulfate	20 grams 30 grams
Potassium Sulfate	150.0 grams	Boron	40 grams
Ammonium Sulfate	100.0 grams	Sulfur Acid	20 grams
GAAP	30 grams	Ammonium Molybdate	2 grams



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GOLF COURSE MANAGEMENT
CONFERENCE
May 4-5, 2017
THE ORCHARD GOLF & COUNTRY CLUB • DASMARIÑAS CITY, PHILIPPINES



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Classic Course #1 Practice Green Fertilizer Trial Plots

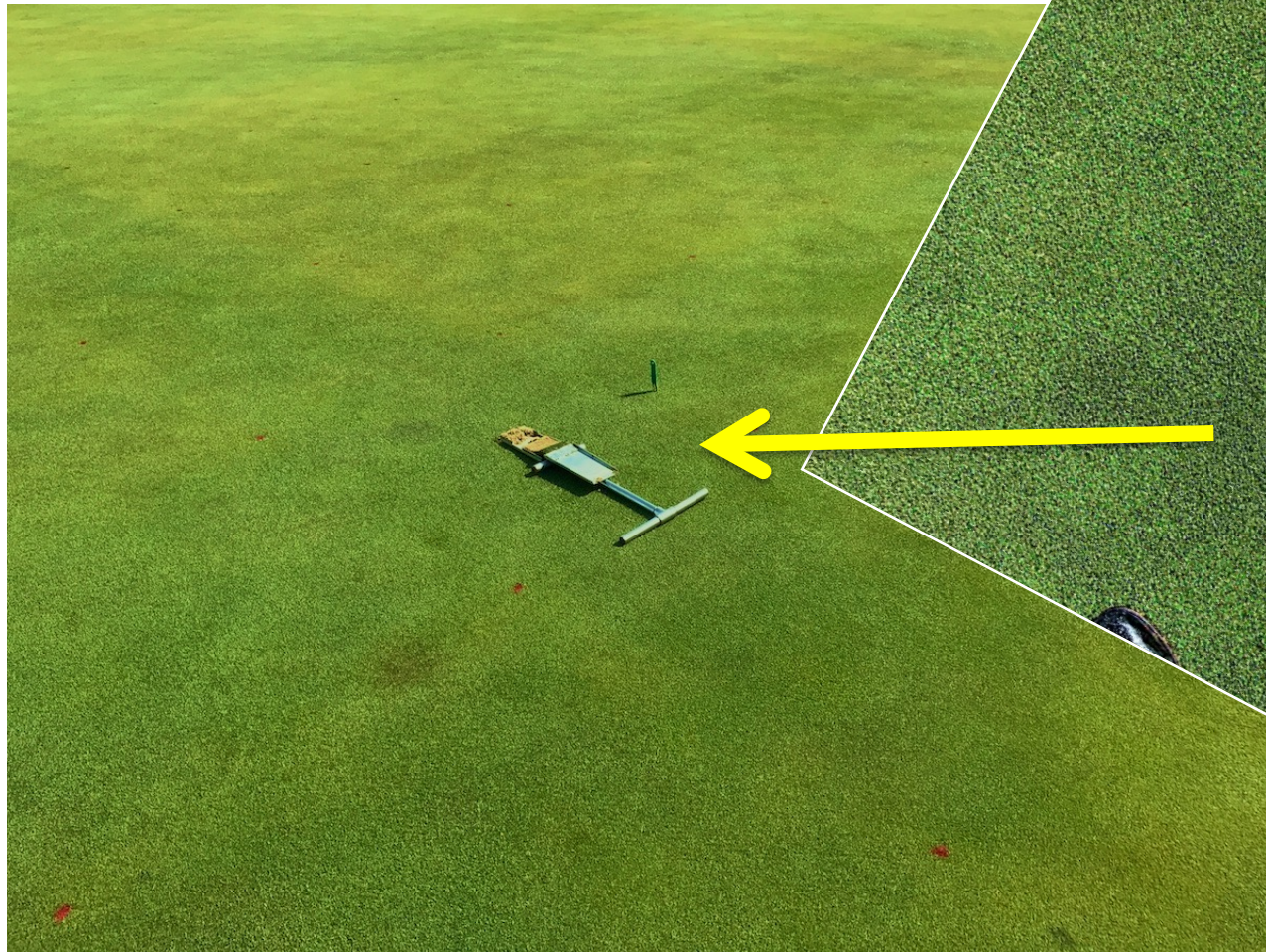
(All nitrogen fertilizers applied at 0.75 grams N / M²)

All plots are 1 meter by 1 meter square
100 separate plot combinations

NORTH is East Path

WEST is Green #1 Row

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
APPLICATIONS		Ammonium Sulfate ↓	Ammonium Molybdate (Mo) 0.25g / M ² ↓	Potassium Nitrate ↓	Calcium Nitrate ↓	CLASSIC COURSE Nutri-Tech 11-10-30 +2 MgSO4 ↓	CHECK ↓	Boric Acid 0.57g / M ² ↓	Urea plus Fe Sulfate 1g Mg Sulfate 1g ↓	Urea ↓	Ammonium Sulfate + Fe Sulfate 1g Mg Sulfate 1g ↓	Iron Sulfate 1 gram ↓	Iron Sulfate 2 grams ↓	Mono Ammonium Phosphate (MAP) (P) ↓	Magnesium Sulfate 2 grams ↓	Magnesium Sulfate 1 grams ↓	PROSTIM (Ocean Course) ↓	OCEAN COURSE Nutri-Amino ↓	Balance (Ocean Course) ↓	NO TREATMENT ASSIGNED ↓	NO TREATMENT ASSIGNED ↓
1	Urea ↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	Urea + Fe Sulfate 1 grams Mg Sulfate 1 ↓	21	22	23	24	25	16	27	28	29	30	31	32	33	34	35	36	37	38	39	40
3	Iron Sulfate 1 gram ↓	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
4	Iron Sulfate 2 grams ↓	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
5	Magnesium Sulfate 2 grams ↓	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
6	Magnesium Sulfate 1 gram ↓	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
7	Ammonium Sulfate + Fe Sulfate 1g Mg Sulfate 1g ↓	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
8	CLASSIC COURSE Nutri-Tech 11-10-30 +2 MgSO4 ↓	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
9	Boric Acid 0.57g / M ² ↓	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
10	Calcium Nitrate ↓	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
11	Mono Ammonium Phosphate (MAP) (P) ↓	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
12	Ammonium Molybdate (Mo) 0.25g / M ² ↓	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
13	Ammonium Sulfate ↓	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
14	OCEAN COURSE Nutri-Amino 10-0-0 ↓	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
15	Potassium Nitrate ↓	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300









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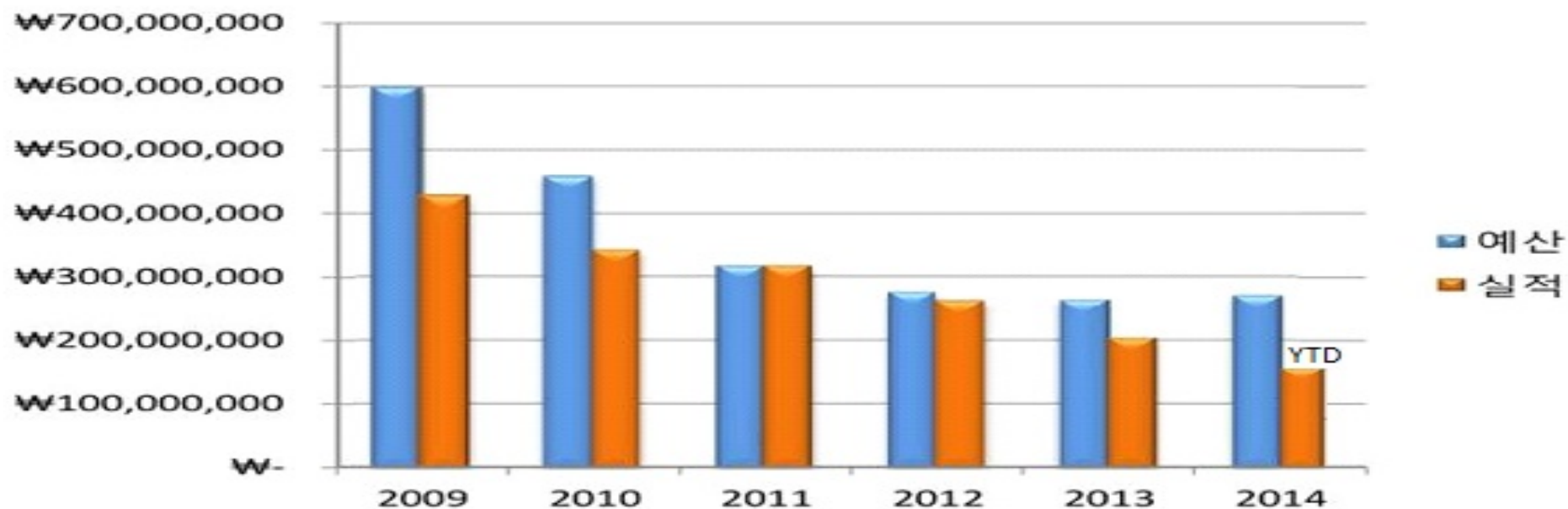
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I've learned and taught that the secret of exceptional golf courses is **BELOW** the surface.



구분	2009	2010	2011	2012	2013	2014
예산	600,000,000	459,760,105	318,162,150	278,452,110	265,887,200	272,529,000
실적	428,658,000	343,186,360	317,623,500	264,049,500	204,329,500	YTD 161,463,600



6. 첨부파일

- 1) 2014 년 비료 입찰 결과 자료
- 2) 2014 년 납품 계약서 8부(업체별)
- 3) 기타 참고 자료(업체별 입찰 취합본)

Knowing Your True Cost Efficacy in Chemical, Fertilizer and Fertigation Use

James Graham Prusa

ROYAL GEMS GOLF RESORT

Nakhon Pathom, THAILAND

ASIAN GOLF COURSE SUPERINTENDENTS SUMMIT

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http://prusaassociates.com/prusa_presentations.htm



HOW TO CALCULATE YOUR FERTILIZER COSTS



PACKAGING!



Pricing Strategies:
Travel
Weddings
Fertilizers!



Single Element Fertilizer Cost Comparison



- Doing single element product comparisons for an element such as Nitrogen (N) is simple.
- An example:

UREA 46-0-0 (20KG bag = ₱ 16,000)

1000 kilograms or 1 metric ton (mt) costs ₱ 800,000

1000 X 0.460 = 460 kg of N costs ₱ 800,000

TRUE COST = ₱ 800,000 / 460 = ₱ 1740 / 1 kg of actual N

LEAST  EXPENSIVE



AMMONIUM SULFATE 21.5-0-0 (20KG bag = ₱ 12,000)

1000 kilograms OR 1 metric ton (mt) costs ₱ 600,000

1000 X 0.215 kg of N costs ₱ 600,000

TRUE COST = ₱ 600,000 / 215 = ₱ 2790 / 1 kg of actual N



Complete or Complex Fertilizer Cost Comparison

Requires Very Simple Algebra

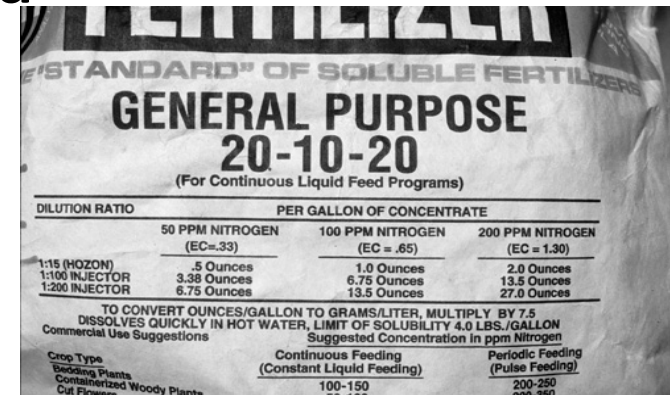
$$A + B + C = X$$

X is the total cost of the fertilizer per a given amount of weight such as a metric ton.

A, B and C represent the different essential plant nutrients *by weight* in the fertilizer and there could be more than only three nutrients (variables).

Since we know the total cost that X represents, we can simply assign a known or defined cost for B and for C variables in order to derive the cost of A.

$$X - B - C = A$$



"STANDARD" OF SOLUBLE FERTILIZERS
GENERAL PURPOSE
20-10-20
(For Continuous Liquid Feed Programs)

DILUTION RATIO	PER GALLON OF CONCENTRATE		
	50 PPM NITROGEN (EC=.33)	100 PPM NITROGEN (EC = .65)	200 PPM NITROGEN (EC = 1.30)
1:15 (HOZON)	.5 Ounces	1.0 Ounces	2.0 Ounces
1:100 INJECTOR	3.38 Ounces	6.75 Ounces	13.5 Ounces
1:200 INJECTOR	6.75 Ounces	13.5 Ounces	27.0 Ounces

TO CONVERT OUNCES/GALLON TO GRAMS/LITER, MULTIPLY BY 7.5
DISSOLVES QUICKLY IN HOT WATER, LIMIT OF SOLUBILITY 4.0 LBS./GALLON
Commercial Use Suggestions

Crop Type	Continuous Feeding (Constant Liquid Feeding)	Periodic Feeding (Pulse Feeding)
Seedling Plants	100-150	200-250
Containerized Woody Plants	100-150	200-250
Cut Flowers	100-150	200-250



CHART OF COSTS FOR ESSENTIAL SINGLE ELEMENTS COMMON IN TURFGRASS FERTILIZERS

FIXED PRICES FOR USE IN WORKSHEET, MULTIPLE VARIABLE FORMULAS. Current Korean market price for commercial fertilizer grade:

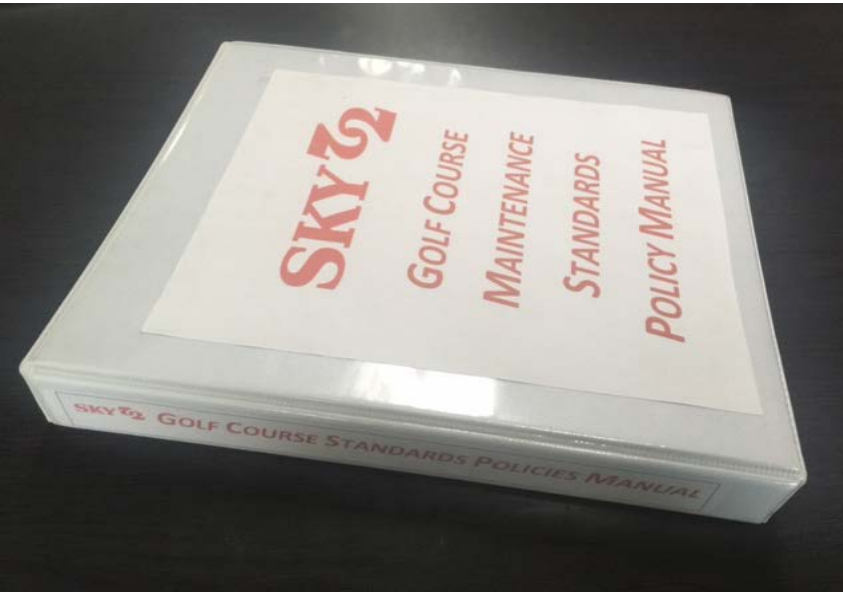
Estimate current price per metric tonne (mt) in Won of this commercial grade product ₩:	Calculated Cost of single essential element:	Plant Uptake Molecule	Estimated percentage of this element (can vary):	Price Per Gram / Kilogram of single fertilizer essential element in ₩ Won :	
Urea 45-0-0 CO(NH ₂) ₂	525,000	N	NO ₃ ⁻ ; NH ₄ ⁺	46.0%	1.141 1,141
Monammonium Phosphate (MAP) 11-61-0 (NH ₄)H ₂ PO ₄ [99% pure N=11.8%; P ₂ O ₅ = 61%]	315,000	P ₂ O ₅	H ₂ PO ₄ ⁻ ; HPO ₄ ⁻² ; PO ₄ ⁻³	61.0%	0.315 315
Potassium Chloride 0-0-61 (KCl) [K = 61%, Cl = 46.5%]	150,000	K ₂ O	K ⁺	61.0%	0.246 246
Soil Sulfur (Brimstone) S	925,000	S	SO ₄ ⁻²	99.0%	0.934 934
Sulfuric Acid H ₂ SO ₄ [98% purity; Solution Density = 1.55; 31% Sulfur]	250,000	S	SO ₄ ⁻²	31.0%	0.078 78
Gypsum (CaSO ₄ ◆2H ₂ O) [Pure: Ca = 23.2%, S = 18.6%]	100,000	Ca	Ca ⁺²	23.2%	0.023 23
Ferrous Sulfate FeSO ₄ ◆7H ₂ O [98% purity: Fe = 19%, S = 10%]	360,000	Fe	Fe ⁻² [ferric ion Fe ⁻³]	19.0%	1.403 1,403
Magnesium Sulfate (Epsom Salt) MgSO ₄ [Mg = 10%, S = 13%]	375,000	Mg	Mg ⁺²	10.0%	2.535 2,535
Manganese Sulfate (Manganous) MnSO ₄ ◆H ₂ O [Mn = 32.3%, S = 17%]	925,000	Mn	Mn ⁺²	32.3%	2.372 2,372
Copper Sulfate CuSO ₄ ◆5H ₂ O [Cu = 25.4%, S = 12.9%]	2,200,000	Cu	Cu ⁺ ; Cu ⁺²	25.4%	8.187 8,187
Zinc Sulfate CuSO ₄ ◆7H ₂ O [Zn = 21%, S = 10%]	3,000,000	Zn	Zn ⁻²	21.0%	13.841 13,841
Sodium Molybdate Na ₂ MoO ₄ ◆2H ₂ O [Mo = 39.3%]	2,000,000	Mo	Mo ₄ ⁻²	39.3%	5.089 5,089
Sodium Borate (Borax) Na ₂ B ₄ O ₇ ◆10H ₂ O [B = 11.3%]	100,000	B	BO ₃ ⁻³	11.3%	0.885 885
Potassium Chloride KCl [K = 61%, Cl = 46.5%]	150,000	Cl	Cl ⁻	46.5%	0.323 323
Calcium Silicate Ca ₂ SiO ₄ [Ca = 46.5 %, Si = 16.5%]	350,000	Si	Cl ⁻	16.5%	2.121 2,121

* In order to establish known values for the three N-P-K cost values, it is necessary to firmly estimate two of three variables (example, P₂O₅ and K₂O) for an algebraic calculation of the price of the predominant element such as the nitrogen (N) variable. The same can be done for non-NPK fertilizers. Thus, objective cost analysis and comparison can be done for complete fertilizers. Absolute cost accuracy of P and K is not necessary for N cost comparison as long as constant values are used for P and K. Periodically update the price of these two products.

ENTER MARKET PRICE ABOVE		ENTER CORRECT % ABOVE IF CHANGED	PRICES REVISED: 2010년 4월 21일
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Setting Clear WRITTEN STANDARDS

- Protects the management, GREENKEEPER & MEMBERSHIP from arbitrary & capricious committees in private clubs
- Assures ACCOUNTABILITY
- Training tool and informative
- Quality Assurance – assures consistency
- Takes time and effort to develop; *annual review*



GOLF COURSE MAINTENANCE OPERATION STANDARDS POLICIES
TABLE OF CONTENTS

Color Code of Table Below:

Yellow highlight text	Completed draft of priority First Phase of standards (March 31)
Blue highlight text	Supplemental standards (Future)
Plain text black	Future standard consideration to write lower priority (January 1)
Staff Course Standards Handbook	Draft this between now and next winter. It will be an abbreviated, abstract of this detailed policy manual that is intended for wider distribution.

INTRODUCTION

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SKY72 sets standards for every aspect of operation.

300 pages of Maintenance Standards!

Over the years I have written these for F&B; lodging, HR, maintenance, security, budgeting, accounting.

Comparison of Particle Size Recommendations for Bunker and Greens' Sand
(병커와 그린 모래를 위한 입자 크기 권장 사항 비교)

US Standard Sieve Mesh	Diameter of Sieve (mm)	Beard Bunker Sand % Retained on Sieve or Fraction	USGA Greensmix Sand % Retained on Sieve or Fraction	California Greens Sand % Retained on Sieve or Fraction
10	2.0	0 %	≤ 3 %	≤ 10 %
18	1.0	0 %	≤ 7 %	
35	0.5	75 % minimum	60 % minimum	
60	0.25	Remainder	≤ 20 %	82 - 100 %
100	0.15		≤ 5 %	
140	0.10	Angular Sands Only. No material less than 0.11 mm	≤ 5 %	0 - 8 %
270	0.05		≤ 5 %	
Silt	0.002		≤ 3 %	
Clay	< 0.002			



FERTILIZER & CHEMICAL INPUTS FOR HEALTHY TURF



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