

Fertilizing Roses

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Fertilizer Basics:

Thirteen elements (nutrients) required for proper growth of roses (in addition to O, H, C)

Look for the amounts on the container (listed as % of contents by weight)

Primary nutrients

N - nitrogen

P - phosphorus (listed as phosphate (P_2O_5))

K - potassium (listed as potash (K_2O))

Secondary nutrients: Ca, Mg, S

Minors: Fe, Mn, Zn, B, Cu, Mo, Cl

Nitrogen drives all fertilizer programs and is found in many forms:

Organic

Natural - derived from plant and animal products (often labeled as water insoluble N - WIN)

Man Made - Urea

Chemical

Ammonium (NH_4^+) (also referred to as ammoniacal-N)

Nitrate (NO_3^-)

Urea and both chemical forms are also processed for extended duration, e.g.:

Urea - IBDU

Coated for controlled release (eg. Osmocote)

Roses (& all plants) Uptake Two Forms of N:

Nitrate N: NO_3^- & Ammonium N: NH_4^+

Uptake ratio for roses approximately: $NO_3^- / NH_4^+ \approx 10$

All fertilizers eventually transform into nitrate (NO_3^-):

Organic (natural & man made) $\xrightarrow{\text{microbes}}$ NH_4^+ $\xrightarrow{\text{microbes}}$ NO_3^-

Soil microbes do the work: time of conversion is temperature dependent. See Appendix 2.

Nominal rose nutrient uptake for a year:

The Hydroponics rose industry has established 'ground truth' for nutrient uptake. Values shown are the nutrients consumed by an average rose over an 8 month growing season. May vary by 20%.

But what happens when we introduce soil. Actual fertilizer requirements in soil may be different. Shaded elements are most important in determining fertilizer requirements - they must be managed continuously through the growing season, because:

N losses can be high - nitrification & leeching

P forms precipitates that are unavailable (i.e., it is fixed)

K is stored by soil but often in smaller quantities than required

S is mobile in soil and easily leached

Fe forms precipitates that make availability marginal

Major Nutrient	Lbs Nutrient per 1000 sq	Minor Nutrient	Lbs Nutrient per acre
N	16	Fe	4.5
P_2O_5	7	Mn	1.5
K_2O	16	Zn	0.9
Ca	9	B	0.8
Mg	4	Cu	0.3
S	5	Mo	0.2

The non-shaded elements are maintained through normal soil management practices.

Ca and Mg are stored by soil in large quantities, relative to plant needs

Lime to correct pH in the fall is sufficient to replenish

Calcitic lime for Ca

Dolomitic lime for Ca & Mg

Minors (except possibly Fe) are normally plentiful in our mid-Atlantic soils

As insurance apply a fertilizer containing minors once or twice a season. An excellent choice is Peters S.T.E.M. (a soluble micronutrient supplement).

Recommended Fertilizer Amounts for Typical Soils:

N - range 1 1/2 to 3 times rose uptake

P₂O₅ - range 2 to 4 times rose uptake

K₂O - range 1 to 2 times rose uptake

S - range 1 to 2 times rose uptake

Fe - range 2 to 4 times rose uptake (chelated)

Fe - range 10 to 20 times (non-chelated)

Nutrient	Amount
N	24 to 48 lbs per 1000 sq ft
P₂O₅	14 to 28 lbs per 1000 sq ft
K₂O	16 to 32 lbs per 1000 sq ft
S	5 to 10 lbs per 1000 sq ft
Fe	10 to 20 lbs per acre - chelated
	45 to 90 lbs/acre - non-chelated

Annual Fertilizer Recommendation

N levels between 30 to 40 lbs/1000 sq ft is a

good target - levels as high as 80 have been observed (on potted plants) with good results (just be sure to water, water, water). Levels well below 24 usually result in reduced performance.

S levels approaching 10 lbs/1000 sq ft are highly recommended. Levels exceeding 10 are acceptable.

K₂O levels should always be at least 16 lbs/1000 sq ft, and levels above 32 are not toxic. With soil testing near 600 lbs K₂O/A (see appendix 1), the lower level of 16 lbs/1000 sq ft is usually acceptable, otherwise go for something around 32.

Fe levels near 10 lbs/A are usually acceptable as many VA soils have adequate levels.(approaching 40 to 60 ppm - see Appendix 1). One or two applications of chelated Fe (eg Sprint/Sequestrene) are more than adequate. Organic (blood meal) and extended duration (Osmocote) sources of Fe should be considered chelated as the Fe is released slowly and available before being fixed.

P₂O₅ levels near the lower range (14 lbs/1000 sq ft) are usually acceptable when soil tests near the high end (1000 lbs/A - see appendix 1).

Some amendments such as Humic acid and Organica Plus PGA will enhance the availability of nutrients, allowing application of reduced amounts of P₂O₅ and Fe closer to the low end of the range.

Humic acid increases the mineralization of micronutrients that would otherwise be fixed

Organica Plus PGA provides beneficial microorganisms which enhance nutrient availability

That's all there is to it! Just manage the 5 nutrients in the table using your favorite fertilizers and your roses will get a balanced diet and be very happy.

Fertilizer Characteristics Table

<u>Fertilizer</u>	<u>Nutrients</u> (%NPK)	<u>N Duration</u> (weeks)	<u>Quantity</u> (cup/tbsp)	<u>Rate</u> %	<u>Nutrients Delivered</u>				
					<u>(lbs/1000 sq ft)</u>				<u>(lbs/A)</u>
					<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>	<u>S</u>	<u>Fe</u>
<u>Extended Duration</u>									
Osmocote 98605 (8-9 mon)	18-5-12 †	28	1.5 cup	112	31.3	8.7	20.9	8.7	37.9
Osmocote Plus (6 mon)	15-9-12 †	18	1.0 cup	97	17.4	10.4	13.9	4.6	22.7
Greenview LF (IBDU)	31-0-0	16	0.75 cup	96	15.4	0	0	0	0
<u>Organic</u>									
Espoma Plant-tone	5-3-3	7	2.0 cup	119	8.3	5.0	5.0	1.7	0
Espoma Rose-tone	4-3-2	7	2.5 cup	115	8.1	6.0	4.0	4.0	0
Mills Magic Rose Mix	6-5-1	7	2.0 cup	129	9.0	7.5	1.5	0	0
Fertrell Rose Food	4-2-4	7	2.0 cup	131	9.1	4.6	9.1	0	0
Organic Mix *	6.8-3.3-8.0-0.4Fe	7	2.0 cup	133	9.4	4.6	1.1	0	24.9
Alfalfa Meal	3-0.5-2	7	1.0 cup	25	1.8	0.3	1.2	0	0
Blood Meal	12-0-0-0.3Fe	5	1.0 cup	139	7.0	0	0	0	7.1
Bone Meal	4-12-0	7	1.0 cup	56	3.9	11.7	0	0	0
Fish Meal	9-3-1	7	1.0 cup	81	5.7	1.9	0.6	0	0
Kelp Meal	1-0-2	7	1.0 cup	12	0.8	0.1	1.7	0	0
Cottonseed Meal	6-2-1	7	1.0 cup	63	4.4	1.5	0.7	0	0
Manure	1-1-1	7	10.0 cup	104	7.3	7.3	7.3	0	0
Milorganite	5-2-0-4Fe	7	4.0 tbsp	15	1.0	0.4	0	0	36.4
* Mix equal parts of alfalfa meal, fish meal, cottonseed meal, blood meal, bone meal & half part Milorganite									
<u>Granular</u>									
Vegetable Grower	10-10-10 †	5	0.5 cup	120	6.0	6.0	6.0	6.9	2.6
Urea	46-0-0	6	3.0 tbsp	113	6.8	0	0	0	0
20-20-20 Granular	20-20-20	6	0.25 cup	100	6.0	6.0	6.0	0	0
<u>Soluble</u>									
Potassium Nitrate	13.75-0-46	2	1.0 tbsp ❖	53	1.06	0	3.54	0	0
Jack's Blossom Booster	10-30-20 †	4	1.0 tbsp ❖	22	0.63	1.88	1.25	0	0.27
Peters Professional Gen Pur	20-10-20 †	4	1.0 tbsp ❖	54	1.42	0.71	1.42	0	0.31
Peters Professional Gen Pur	20-20-20 †	4.5	1.0 tbsp ❖	32	1.21	1.21	1.21	0	0.13
Miracle-Gro Blossom Booster	15-30-15 †	4.5	1.0 tbsp ❖	13	0.75	1.49	0.75	0	0.33
Jack's Classic All Purpose	20-20-20 †	5	1.0 tbsp ❖	22	1.08	1.08	1.08	0	0.23
Miracle-Gro for Roses	18-24-16 †	5	1.0 tbsp ❖	18	1.06	1.41	0.94	0	0.26
Fish Emulsion	5-1-1	6	1.0 tbsp ❖	6	0.36	0.07	0.07	0	0
<u>Supplements</u>									
Gypsum	21Ca-17S	n/a	4.0 tbsp	n/a	0	0	0	5.3	0
Epsom salts	10Mg-14S	n/a	1.0 tbsp ❖	n/a	0	0	0	1.0	0
Sul-Po Mag	22K-11Mg-22S	n/a	1.0 tbsp	n/a	0	0	2.2	2.2	0
Potash (Muriate of)	60K	n/a	1.0 tbsp	n/a	0	0	4.4	0	0
Sulfate of Potash	50K-18S	n/a	1.0 tbsp	n/a	0	0	4.4	1.6	
Superphosphate	0-20-0	n/a	2.0 tbsp	n/a	0	2.8	0	0	0
Triple Superphosphate	0-45-0	n/a	1.0 tbsp	n/a	0	3.2	0	0	0
Sequestrene 330 Iron Chelate	0-0-0-10Fe	n/a	0.33 tbsp ❖	n/a	0	0	0	0	8.1
Peters S.T.E.M.	minors only	n/a	0.25 tbsp ❖	n/a	0	0	0	0.2	6.1
Dragon Iron Chelate w/minors	0-0-0-6Fe †	n/a	0.5 tbsp ❖	n/a	0	0	0	0.1	9.1

Specialty Growth Stimulate Additives

Humic Acid ❖	1.0 tbsp/gal - 1 gal/bush/month	• improves (by 20X) mineralization of nutrients, CEC, soil structure
SuperThrive ❖	4.0 tbsp/32 gal - 1 gal/rose (or 0.375 tsp/rose) - apply 2 to 3 times a year	• stimulates growth (triacontanol)
Response	Foliar feeding - 1tbsp per gallon of spray - apply monthly	• stimulates growth & resistance to disease
Organica PGA Plus ❖	3 tbsp/1000 sq ft or 1/2 tbsp/32 gal - 1 gal/rose - apply monthly	• beneficial microorganisms

† Contains minors

❖ Mix with water and apply as a liquid ground drench

Example 1 - All Organic - Espoma Plant-tone

Date	Amount Fertilizer (30" bush)	Duration weeks	Rate %	N	P	K	S	Fe lbs/A
				lbs/1000 sq ft				
Apr 15	2 cup Plant-tone	7	119	8.3	5.0	5.0	1.7	0
Jun 15	2 cup Plant-tone	7	119	8.3	5.0	5.0	1.7	0
Aug 15	2 cup Plant-tone	7	119	8.3	5.0	5.0	1.7	0
Total				24.9	15.0	15.0	5.1	0
Apr	1/2 cup Milorganite	7	30	2.0	0.8	0	0	72.8
Apr	1 tbsp Muriate of Potash	-	-	0	0	4.4	0	0
Total				26.9	15.8	19.4	5.1	72.8

Example 2 - All Organic - Mills Magic Mix

Date	Amount Fertilizer (30" bush)	Duration weeks	Rate %	N	P	K	S	Fe lbs/A
				lbs/1000 sq ft				
Apr 15	2 cup Mills Magic Mix	7	129	9.0	7.5	1.5	0	0
Apr	1/2 cup Milorganite	7	30	2.0	0.8	0	0	72.8
Apr	2 tbsp Sulfate of Potash	-	-	0	0	8.8	3.2	0
Jun 15	2 cup Mills	7	129	9.0	7.5	1.5	0	0
Jul/Aug	2 tbsp Sulfate of Potash	-	-	0	0	8.8	3.2	0
Aug 15	2 cup Mills	7	129	9.0	7.5	1.5	0	0
Total				29.0	23.3	22.1	6.4	72.8

Example 4 - All Organic - with liquid supplements and stimulants

Date	Amount Fertilizer (30" bush)	Duration weeks	Rate %	N	P	K	S	Fe lbs/A
				lbs/1000 sq ft				
Apr 1	Liquid Formula *	6	28	1.57	1.28	1.28	2.0	8.21
Apr 15	1 cup Mills	7	65	4.5	3.8	0.8	0	0
Apr 15	1 cup kelp meal	7	12	0.8	0.1	1.7	0	0
Apr 15	1 cup fish meal	7	81	5.7	1.9	0.6	0	0
Apr 15	1 cup alfalfa meal	7	25	1.8	0.3	1.2	0	0
Apr 15	2 tbsp Muriate of Potash	-	-	0	0	8.8	0	0
May 1	Liquid Formula **	6	28	1.57	1.28	1.28	2.0	0.13
May 15	1/2 cup Blood Meal	5	70	3.5	0	0	0	3.5
Jun 1	Liquid Formula	6	28	1.57	1.28	1.28	2.0	0.13
Jun 15	1 cup Mills	7	65	4.5	3.8	0.8	0	0
Jun 15	1/2 cup Blood Meal	5	70	3.5	0	0	0	3.5
Jul 1	Liquid Formula	6	28	1.57	1.28	1.28	2.0	0.13
Jul 15	1/2 cup Blood Meal	5	70	3.5	0	0	0	3.5
Aug 1	Liquid Formula **	6	28	1.57	1.28	1.28	2.0	0.13
Aug 15	1 cup Mills	7	65	4.5	3.8	0.8	0	0
Aug 15	1/2 cup Blood Meal	5	70	3.5	0	0	0	3.5
Sep 1	Liquid Formula **	6	28	1.57	1.28	1.28	2.0	0.13
Totals				45.2	21.4	22.4	12.0	22.9

* Include Sequestrene 330 FE chelated iron

** include SUPERthrive

To make the Liquid Formula, mix the following products together in water. For a large number of roses, mix in large quantities, e.g. for 32 gallons of water, 1 tbsp/gal equals 2 cups (32 tbsp) in 32 gallons, and 2 tbsp/gal is 4 cups. Or if using a hose end sprayer and dripper system, combine all the

ingredients together in the jar of the hose-end sprayer. The quantity is just the amounts shown times the number of roses in the bed.

Liquid Formula	Duration	Rate	N	P	K	S	Fe
	weeks	%	lbs/1000 sq ft				lbs/A
1 tbsp/gal Peters Prof 20-20-20	2.5	54	1.21	1.21	1.21	0	0.13
1 tbsp/gal fish emulsion	6	6	0.36	0.07	0.07	0	0
2 tbsp/gal Epsom salt	-	-	0	0	0	2.0	0
1 tbsp humic acid	-	-	0	0	0	0	0
1 tsp/gal Sequestrene 330 FE †	-	-	0	0	0	0	8.1
0.375 tsp/gal SUPERthrive †	-	-	-	-	-	-	-
Total	6	60	1.57	1.28	1.28	2.0	8.21

† optional items - not used except as called for

Note: SUPERthrive, the phony looking bottle aside, is a legitimate, very concentrated form of triacontanol, developed during WWII to improve corn production. This is a known growth stimulant for roses. The more traditional method of making triacontanol, involves mixing about 12 cups of alfalfa pellets in 32 gallons of water, and letting it ferment for about 6 or 7 days. The fermentation of alfalfa extracts the alcohol triacontanol. This process is messy, and if you don't like brewing your own, SUPERthrive is a good alternative, and diluted at 4.0 tbsp/32 gallons, a little bit goes a long way.

Be sure to check the sums of the **rates** for applications that overlap in time. The sum should not exceed 250%. For example: multiple products applied Apr 15:

1 cup Mills	65%
1 cup kelp	12
1 cup fish	81
1 cup alfalfa	25
Total	183%

Good, but notice the 15 May feeding of blood meal overlaps (by 3 weeks) with the April 15 feeding and must be included. Thus:

Apr 15	183%
May 15	70%
Total	253%

Slightly over my 250% limit but OK. The rest of the year is OK.

Conversion of Quantities to Drip Lines other than 30 inches

The quantity of fertilizer applied, above, is valid for roses with 30 inch drip lines or equivalently roses spaced on 30 inch centers. For larger roses increase the quantity applied and for smaller roses decrease the quantity, by the factor shown in the table, to result in the same nutrients.

For example, 2 cups of Mills Magic Mix will provide 9.0 lbs N/1000 sq ft when spread about a 30 inch drip line, but to provide that same 9.0 lbs N/1000 sq ft for a 36 inch drip line rose would require, from the table X1.44, or 2 x 1.44 or 2.88 cups of Mills.

Drip Line Dia Inches	Area Sq ft	Conversion
60	19.635	X4.00
48	12.566	X2.56
42	9.621	X1.96
36	7.069	X1.44
30	4.909	X1.00
24	3.142	X0.64
18	1.767	X0.36
12	0.785	X0.16
8	0.349	X0.07
6	0.196	X0.04

Drip Line Conversions

Send comments & questions to davesroses@yahoo.com

Appendix 1

Typical Soil Test Results:

Ratings (VH, H, M, L) - subjective indications of the expected response to adding fertilizer (L always respond - VH never respond) based on typical VA commercial crops. **However, ratings not valid for roses. Roses require substantially higher levels.**

LAB TEST RESULTS (see Note 1)

Analysis	P (lb/A)	K (lb/A)	Ca (lb/A)	Mg (lb/A)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Fe (ppm)	B (ppm)	S.Salts (ppm)
Result	1046	285	7715	787	19.3	23.4	0.4	14.8	0.8	
Rating	VH	H+	VH	VH	SUFF	SUFF	SUFF	SUFF	SUFF	

Analysis	Soil pH	Buffer Index	Est.-CEC (meq/100g)	Acidity (%)	Base Sat. (%)	Ca Sat. (%)	Mg Sat. (%)	K Sat. (%)	Organic Matter (%)
Result	6.5	6.26	23.7	3.5	96.5	81.3	13.7	1.5	

FERTILIZER AND LIMESTONE RECOMMENDATIONS

Crop: ROSES (212)

619. Lime recommendations: NONE NEEDED.

Results are shown in lb/A for macronutrients and ppm for micronutrients, where 2 ppm = 1 lb/A. Desirable soil test results are shown in the table.

Soil pH - H⁺ ions in solution - value a pH meter would read - 6.5 ideal.

Buffer Index (pH) - H⁺ ions stored on soil's positively charged storage 'colloids' - available for release to soil solution. Acts as a buffer to change. Used to determine lime requirements.

Lime recommendation: "NONE NEEDED" is **incorrect. Lime is required to raise the Buffer Index to 6.5 or above.**

CEC (Cation Exchange Capability) is a measure of soils storage capability. 23.7 is typical of soils with high clay and/or organic content. Average is about 15.

Base saturation (%) - measure of the relative content of the elements Ca, Mg & K. Maintaining ideal % is claimed by some to improve air & water circulation. However, in our highly improved soil, this is of less importance, and performance is unaffected over a wide range of ratios - absolute levels being far more important.

Maintaining base saturation for each element within the range shown and Ca above 3000 lbs/A will guarantee adequate Ca & Mg.

Goal ratios are::

Ideal Ca/Mg ratio = 6.5, Acceptable Ca/Mg range = 2 to 11

Ideal Ca/K ratio = 13, Acceptable Ca/K ratio >1

Ideal Mg/K ratio 2, Acceptable Mg/K ratio > 1

Element	Low	High	Units
P	250	1000	lbs/A
K	250	600	lbs/A
Ca	3000	10000	lbs/A
Mg	400	1000	lbs/A
Fe	15	60	ppm
Mn	15	40	ppm
Zn	5	20	ppm
B	0.5	1.5	ppm
Cu	0.2	2	ppm

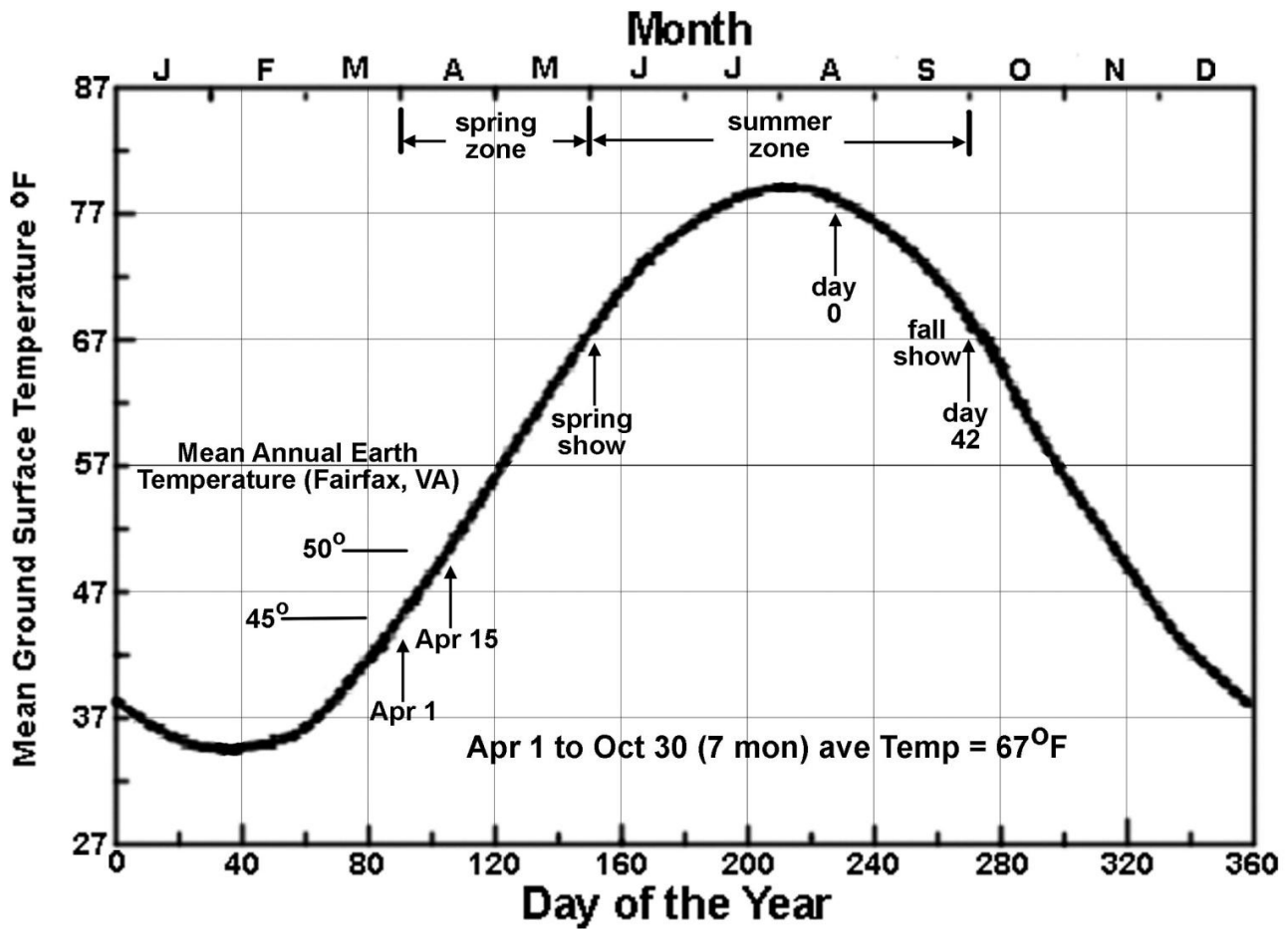
Ideal Soil Test Results

Ideal	Element	Range
78%	calcium	65 - 85%
12%	magnesium	8 - 20%
6%	potassium	3 - 8%
1%	hydrogen	0 - 10%

Base Nutrient Balance

Appendix 2

The conversion of Organic (natural and man-made) fertilizers to plant useable forms is temperature dependent. The average soil temperature for the Wash, DC area is shown.



For example the nitrification (conversion) of ammonium to nitrate has the following temperature dependence:

80°F	16 days	August 5
67°F	20 days	May 25 & Oct 5
40°F	9 weeks	March 15

Some chemical (or partially chemical) fertilizers (urea is not considered a chemical fertilizer):

FERTILIZER	% Nitrate-N	% Ammonium-N	% Urea
Osmocote 18-5-12	8.5	9.5	0
Osmocote 15-9-12	7	8	0
Vegetable Grower 20-20-20	0	20	0
Potassium Nitrate 13.75-0-46	13.75	0	0
Jack's Blossom Booster 10-30-2	5	5	0
Peters Pro Gen Purpose 20-20-20	5.3	6.9	7.8
Jack's Classic All Purpose 20-20-20	2.1	0	17.9
Mills Easy Feed 14-6-4	1.31	1.8	10.89
Miracle-Gro Blossom Booster 15-30-15	0	5.8	9.2
Miracle-Gro for Roses 18-24-16	0	2.4	15.6