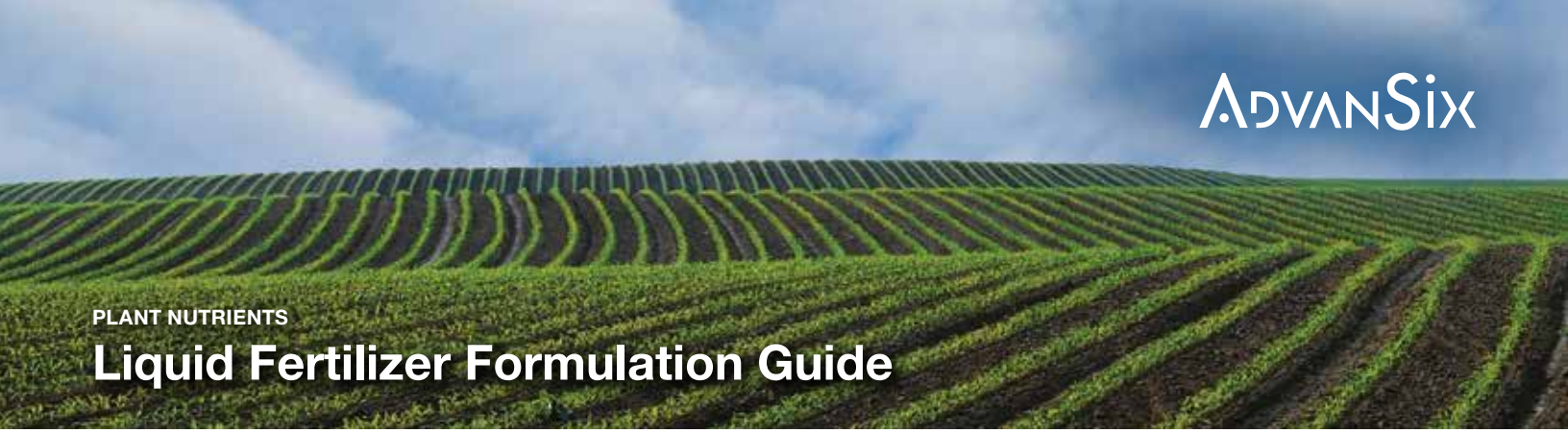

PLANT NUTRIENTS

Liquid Fertilizer Formulation Guide

Sulf-N® Ammonium Sulfate Formulations

This formulation guide contains liquid blending formulas using Sulf-N® ammonium sulfate, as well as useful tips for making liquid fertilizer blends.

Liquid Fertilizer Formulations – Raw Materials

Raw Materials	Nutrient Content
Sulf-N® Ammonium Sulfate	21-0-0-24S
Urea Ammonium Nitrate 28 (UAN 28)	28-0-0
Urea Ammonium Nitrate 30 (UAN 30)	30-0-0
Urea Ammonium Nitrate 32 (UAN 32)	32-0-0
Ammonium Polyphosphate (APP)	10-34-0
Ammonia (NH3)	82-0-0
Phosphoric Acid	0-54-0
Potash (KCl)	0-0-62

When ammonium sulfate and potassium chloride are used in clear liquid formulations, you must limit the potash analysis to 6% and the sulfur (S) analysis to 2%. Potash (potassium chloride) reacts with ammonium sulfate to form ammonium chloride and potassium sulfate. Potassium sulfate has low solubility.

If you need more potash in a particular grade that contains ammonium sulfate, it will be necessary to make a suspension. When making suspensions, always be certain that the ammonium sulfate is dissolved in the water before the potash is added.

All grades in this guide have a salt-out temperature of 32°F (0°C) or less.

If you prefer to pre-dissolve your ammonium sulfate, it is possible to make a base solution of 8-0-0-9S as indicated below.

Preparation of a One-Ton Batch of Sulf-N® 8-0-0-9S Base Solution

1. Add 762 pounds of dry Sulf-N® (21-0-0-24S) to 1,238 pounds or 149 gallons of water.
2. Add two gallons of aqua ammonia (21% N) for every 10 tons of 8-0-0-9S to take pH up to 6.5.
3. When storing Sulf-N® solution in mild steel or thin-wall aluminum tanks, add one gallon of ammonium polyphosphate (10-37-0 or 10-34-0) to every 10 tons of 8-0-0-9S as a corrosion inhibitor (not needed when using plastic or stainless steel tanks).

Formulation

Sulf-N® Ammonium Sulfate, 21-0-0-24S

UAN 30, 30-0-0

Guaranteed Analysis				Sulf-N®	UAN 30	UAN 30	Water	Water	Total
N	P_2O_5	K_2O	S	Pounds	Gallons	Pounds	Gallons	Pounds	Pounds
10	0	0	8	668	12.3	134	135.9	1132	2000
12	0	0	7	584	36.1	392	122.9	1024	2000
14	0	0	6	500	53.8	584	110.0	916	2000
16	0	0	5	418	71.5	776	96.8	806	2000
18	0	0	4	334	89.1	968	83.8	698	2000
20	0	0	4	334	101.3	1100	67.9	566	2000
22	0	0	3	250	119.0	1292	55.0	458	2000
24	0	0	2	168	136.6	1484	41.8	348	2000
25	0	0	3	250	137.5	1492	31.0	258	2000
26	0	0	1	84	160.4	1742	20.9	174	2000
28	0	0	2	167	161.3	1750	9.98	83	2000

Formulation

Sulf-N® Ammonium Sulfate, 21-0-0-24S

UAN 28, 28-0-0

Guaranteed Analysis				Sulf-N®	UAN 28	UAN 28	Water	Water	Total
N	P_2O_5	K_2O	S	Pounds	Gallons	Pounds	Gallons	Pounds	Pounds
8	0	0	9	762	0	0	148.6	1238	2000
9	0	0	8	668	13.5	144	142.6	1188	2000
11	0	0	7	584	32.6	348	128.2	1068	2000
13	0	0	6	500	51.9	554	113.6	946	2000
17	0	0	5	418	84.5	902	81.6	680	2000
19	0	0	4	334	103.8	1108	67.0	558	2000
21	0	0	3	250	123.1	1314	52.3	436	2000
23	0	0	2	168	142.4	1518	37.7	314	2000
25	0	0	1	84	161.6	1724	23.0	192	2000
25	0	0	3	250	150.0	1598	18.3	152	2000

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Formulation

Sulf-N® Ammonium Sulfate, 21-0-0-24S

Ammonium Polyphosphate, 10-34-0

Guaranteed Analysis				Sulf-N®	UAN 28	UAN 28	Water	Water	Total
N	P_2O_5	K_2O	S	Pounds	Gallons	Pounds	Gallons	Pounds	Pounds
5	5	0	4.0	336	24.7	294	164.5	1370	2000
5	8	0	3.0	252	39.7	472	153.2	1276	2000
5	10	0	2.4	196	49.5	588	146.0	1216	2000
5	14	0	1.0	84	69.3	824	131.1	1092	2000
6	12	0	2.8	236	59.4	706	127.0	1058	2000
6	14	0	2.2	180	69.3	824	119.6	996	2000
7	3	0	7.0	584	14.8	176	148.9	1240	2000
7	6	0	6.0	500	29.8	354	137.3	1146	2000
7	7	0	5.6	472	34.7	412	134.0	1116	2000
7	9	0	5.0	416	44.6	530	126.5	1054	2000
7	12	0	4.0	332	59.4	706	115.5	962	2000
7	14	0	3.3	276	69.3	824	108.0	900	2000
7	15	0	3.0	246	74.2	882	104.7	8.72	2000
8	12	0	5.1	426	59.4	706	104.2	868	2000
8	18	0	3.1	258	89.2	1060	81.9	682	2000
9	18	0	4.2	354	89.2	1060	70.3	586	2000
9	24	0	2.2	186	118.8	1412	48.3	402	2000
10	28	0	2.3	190	138.8	1650	20.4	170	2000
11	31	0	2.2	180	153.0	1820	0	0	2000

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Formulation

Sulf-N® Ammonium Sulfate, 21-0-0-24S

UAN 32, 32-0-0

Ammonium Polyphosphate, 10-34-0

Guaranteed Analysis				Sulf-N®	UAN 32	UAN 32	APP	APP	Water	Water	Total
N	P_2O_5	K_2O	S	Pounds	Gallons	Pounds	Gallons	Pounds	Gallons	Pounds	Pounds
10	5	0	7	584	13.6	150	24.7	294	116.7	972	2000
10	10	0	5	418	15.2	168	49.5	588	99.2	826	2000
11	22	0	2	168	15.7	174	108.8	1294	43.7	364	2000
12	12	0	4	334	28.2	312	59.4	706	77.8	648	2000
12	24	0	1	84	23.0	254	118.8	1412	30.0	250	2000
14	7	0	5	418	42.9	474	34.7	412	83.6	696	2000
14	14	0	3	250	41.1	454	69.3	824	56.7	472	2000
16	8	0	4	334	57.4	634	39.7	472	67.2	560	2000
16	6	0	2	168	54.1	598	79.2	942	35.1	292	2000
17	10	0	3	250	64.8	716	49.5	588	53.5	446	2000
18	9	0	3	250	72.0	796	44.6	530	50.9	424	2000
19	9	0	2	168	82.7	914	44.6	530	46.6	388	2000
20	10	0	2	168	86.7	958	49.5	588	34.3	286	2000
21	3	0	3	250	99.0	1094	14.8	176	57.6	480	2000
22	11	0	1	84	101.2	1118	54.5	648	18.0	150	2000
24	8	0	1	84	117.5	1298	39.7	472	17.5	146	2000
25	5	0	1	84	128.1	1416	24.7	294	24.7	206	2000

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Formulation

Sulf-N® Ammonium Sulfate, 21-0-0-24S

UAN 30, 30-0-0

Ammonium Polyphosphate, 10-34-0

Guaranteed Analysis				Sulf-N®	UAN 30	UAN 30	APP	APP	Water	Water	Total
N	P_2O_5	K_2O	S	Pounds	Gallons	Pounds	Gallons	Pounds	Gallons	Pounds	Pounds
10	5	0	7	584	14.7	160	24.7	294	115.5	962	2000
10	10	0	5	418	16.6	180	49.5	588	97.7	814	2000
10	20	0	3	250	19.2	100	98.9	1176	56.9	474	2000
11	22	0	2	168	17.1	186	108.8	1294	42.3	352	2000
12	6	0	6	500	30.6	332	29.8	354	102.5	854	2000
12	12	0	4	334	30.6	332	59.4	706	75.4	628	2000
12	18	0	3	250	25.0	272	89.2	1060	50.2	418	2000
12	24	0	1	84	25.0	272	118.8	1412	27.9	232	2000
14	7	0	4	334	51.9	564	34.7	412	82.8	690	2000
14	14	0	3	250	44.6	484	69.3	824	53.1	442	2000
16	4	0	4	334	69.6	756	19.8	236	80.9	674	2000
16	14	0	2	168	62.2	676	69.3	824	39.9	332	2000
18	4	0	4	334	81.8	888	19.8	236	65.1	542	2000
18	9	0	2	168	83.6	908	44.6	530	47.3	394	2000
18	16	0	1	84	76.2	828	79.2	942	17.5	146	2000
19	9	0	2	168	82.7	914	44.6	530	46.6	388	2000
20	4	0	3	250	99.4	1080	19.8	236	52.1	434	2000
20	10	0	1	84	99.4	1080	49.5	588	29.8	248	2000
22	8	0	1	84	115.3	1252	39.7	472	23.0	192	2000
24	6	0	1	84	131.1	1424	29.8	354	16.6	138	2000
25	4	0	1	84	140.9	1530	19.8	236	18.0	150	2000

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Formulation

Sulf-N® Ammonium Sulfate, 21-0-0-24S

UAN 28, 28-0-0

Ammonium Polyphosphate, 10-34-0

Guaranteed Analysis				Sulf-N®	UAN 30	UAN 30	APP	APP	Water	Water	Total
N	P_2O_5	K_2O	S	Pounds	Gallons	Pounds	Gallons	Pounds	Gallons	Pounds	Pounds
10	5	0	7	584	16.1	172	24.7	294	114.0	950	2000
10	10	0	5	418	18.0	192	49.5	588	96.3	802	2000
11	22	0	2	168	18.7	200	108.8	1294	40.6	338	2000
12	12	0	4	334	33.4	356	59.4	706	72.5	604	2000
12	24	0	3	84	27.2	290	118.8	1412	25.7	214	2000
14	7	0	4	334	56.6	604	34.7	412	78.0	650	2000
14	14	0	3	250	48.5	518	69.3	824	49.0	408	2000
16	8	0	3	250	73.9	788	39.7	472	58.8	490	2000
16	6	0	1	84	69.7	744	79.2	942	27.6	230	2000
18	9	0	2	168	91.1	972	44.6	530	39.6	330	2000
20	5	0	2	168	112.5	1200	24.7	294	40.6	338	2000
20	10	0	1	84	108.3	1156	49.5	588	20.6	172	2000
21	3	0	2	168	123.0	1312	14.8	176	41.3	344	2000
22	7	0	1	84	127.6	1362	34.7	412	17.0	142	2000
24	3	0	1	84	140.0	1590	14.8	176	18.0	150	2000

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Formulation

Sulf-N® Ammonium Sulfate, 21-0-0-24S

UAN 32, 32-0-0

Ammonia, 82-0-0

Phosphoric Acid, 0-54-0

Potash, 0-0-62

Guaranteed Analysis				Sulf-N®	UAN 32	Phos Acid	NH_3	Potash	Water	Total	SOT**
N	P_2O_5	K_2O	S	Pounds	Gallons	Pounds	Gallons	Pounds	Gallons	Pounds	Estimate
6	6	6	2	167	140	225	50	200	1218	2000	23ºF (-5ºC)
8	8	8	1	85	275	300	67	260	1013	2000	21ºF (-6.1ºC)
7*	16	6	2	167	-	600	132	200	901	2000	30ºF (-1.1ºC)

**Needs cooling*
***Salt-out temperature*

Suggested Order of Addition:

1. Water
2. Phosphoric Acid
3. Ammonia
4. UAN 32
5. Sulf-N® Ammonium Sulfate
6. Potash

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Adding 8-0-0-9S to UAN Solution

Mixing 8-0-0-9S with UAN solution results in the addition of sulfur and nitrogen, making it necessary to subtract some UAN to maintain your target nitrogen (N) rate. The chart below calculates UAN subtraction values in both pounds and gallons for 28%, 30% and 32% solutions.

		Amount of Base Solution Required		Equivalent Amounts of UAN to Be Subtracted from Original Formula					
S Units	**N Units Contained**	**Pounds 8-0-0-9**	**Gallons 8-0-0-9**	**Pounds UAN 32**	**Gallons UAN 32**	**Pounds UAN 30**	**Gallons UAN 30**	**Pounds UAN 28**	**Gallons UAN 28**
1	0.9	222	22	56	5	60	5.5	64	6
2	1.8	444	44	111	10	119	11.0	127	12
3	2.7	667	66	167	15	179	16.5	191	18
4	3.6	889	88	222	20	239	22.0	254	24
5	4.5	1111	110	278	25	299	27.0	318	30
6	5.4	1333	131	331	30	359	33.0	381	36
7	6.3	1556	153	389	35	418	38.5	445	42
8	7.2	1778	175	445	40	478	44.0	508	48
9	8.0	2000	197	500	45	538	49.5	572	54

How To Use the Table Above

For example, to mix a one-ton batch of an N-P-K-2% sulfur grade, read down the left-hand column (S Units) to “2.” Reading across to the third column, 444 pounds of base solution (8-0-0-9S) would be required per ton. Reading across the remaining columns, find the amounts of UAN 32, UAN 30 or UAN 28 (in pounds or gallons) to subtract from the original formulation due to the N contained in the base solution.

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Useful Tips

- Characteristics of Sulf-N® 8-0-0-9S Base Solution
  - Density = 10.14 lb/gallon
  - Salt-out temperature = 15ºF (-9.4ºC)
  - One ton of dry Sulf-N® will produce 2.63 tons or 519 gallons of 8-0-0-9S
  - One ton of 8-0-0-9S consists of 197 gallons
  - Amber color

- Clear liquids are usually less than 30% plant food.

- When using Sulf-N® in clear liquid mixtures, 28% plant food is the practical top limit.
  Example: 25–0–0–3.5S

- When Sulf-N® is used in a clear liquid grade, the potash plus sulfur should not be above 8%.
  Example: 7–16–6–2S

- Clear liquid grades with potash will work best if the sulfur from Sulf-N® is kept at 2% or less.

- Sulf-N® is quite soluble in 10-34-0 (ammonium polyphosphate). 200 pounds of Sulf-N® can be added to 1,800 pounds of 10-34-0 without any water.
  Formula: 11.1–30.6–0–2.4S

- Order of addition of Sulf-N® to a clear liquid: it is usually best to add Sulf-N® last (mixes with potash are an exception).

- A suspension of sulfate and water can contain up to 71.5% Sulf-N®.

- Solutions made with Sulf-N® don't get as cold as solutions made with other common sources. When dissolved in water, solid ammonium nitrate, urea and potash produce a stronger cooling effect, known as the negative heat of solution, each about twice that of Sulf-N®.
  Example: Potash 139 Btu/lb
  Sulf-N® 59 Btu/lb

- The pH of 8-0-0-9S made with Sulf-N® usually is in the 4.2 - 4.8 range. This pH can be buffered to:
  - 5.6 by addition of one gallon of 10-34-0 per ton of 8-0-0-9S.
  - 6.5 by addition of two gallons of aqua ammonia (21% N) for every 10 tons of 8-0-0-9S.

- A 43% solution of ammonium sulfate can be used in warm weather at 60ºF (15.5ºC) and above. This is a 9-0-0-10S solution.

Contact AdvanSix
To learn more about the benefits of Sulf-N® Ammonium Sulfate, visit **AdvanSix.com** or **SulfN.com** or call:
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