Agronomy Note

Solubility of Solubor in liquid fertilizers

- Boron deficiencies in crops can be conveniently corrected by soil applications of boron sources included in liquid or granular N, NP and NPK fertilizers.
- *Solubor*® is an excellent boron source for inclusion in liquid fertilizers because it is readily soluble and does not react with other components of these fertilizers.
- *Solubor* is very soluble in urea-ammonium nitrate (UAN) solutions and in 10-34-0 and 7-21-7 liquid fertilizers, ranging from 1.5 - 8.0% *Solubor* in stable solutions.
- The maximum *Solubor* solubility in these liquid fertilizers is greater than that needed to provide the recommended boron rates at the usual NPK rates.

The recommended soil application rate of boron (B) generally ranges from 0.25 to 2.0 lbs of B/acre. Because it is difficult to separately apply these low rates of boron fertilizers to soil, granular or fluid NPK fertilizers generally are used as carriers of boron.

Such application assures more uniform application of boron to the soil and also eliminates the cost of separate applications. Soluble boron sources, such as *Solubor*, may be easily mixed with fluid fertilizers to provide the recommended boron rates for crops.

Solubility studies of Solubor in various liquid fertilizers

Studies were conducted to determine the maximum solubility of *Solubor* in typical liquid fertilizers applied in the U.S. These are UAN solutions (28 and 32% N) and 10-34-0 ammonium polyphosphate solution. Also included was a 7-21-7 fluid fertilizer, based on 10-34-0, because it is widely used as a starter fertilizer.

Salt-out temperatures of all fluid fertilizers at various *Solubor* contents were determined because of potential salt-out problems with storage of boron-containing fertilizer solutions.

Results in Table 1 summarize the maximum solubility of *Solubor* in these fertilizers. Highest solubility was in 10-34-0 fertilizer. Inclusion of KCl in the 7-21-7 fertilizer reduced the maximum *Solubor* solubility, due to the higher salt content of this fertilizer. The maximum solubility was lower in the UAN solution with 32% N than 28% N for the same reason.

The salt-out temperatures of all liquid fertilizers containing the maximum percentages of *Solubor* are lower than those during the growing season. This suggests that there should be no problems with short-term storage of NPK fluid fertilizers containing *Solubor* during that time. It was found that potassium salts crystallized out of the 7-21-7 fertilizer at temperatures below 35°F, but salts did not precipitate until the temperature reached -4°F. Solubility of *Solubor* increased only slightly with increased temperature to about 75°F.

Based on these results, the maximum rates of boron which can be applied at usual N, NP, or NPK rates with these liquid fertilizers (100 - 250 lbs of product/acre) range from 0.3 to 4.0 lbs of B/acre (Table 2). Since the recommended application rates of boron usually range from 0.25 - 2.0 lbs/acre, such boron rates can be conveniently applied by inclusion of *Solubor* in these liquid fertilizers. It is important to dissolve the correct amount of *Solubor* to provide the desired rate of boron at the intended liquid fertilizer application rate.

Solubor may be easily mixed with fluid fertilizers to provide the recommended boron rates for crops.

Agronomy Note

Solubility of Solubor in liquid fertilizers

Table 1: Maximum solubility of *Solubor* and salt-out temperatures in four liquid fertilizers		
Fluid fertilizer	**Maximum solubility, % *Solubor* (by weight)**	**Salt-out temperature**
28% UAN*	2.0	-4°F
32% UAN*	1.5	35°F
10-34-0	8.0	-4°F
7-21-7	4.0	35°F**

* Urea-ammonium nitrate solution containing 28 or 32% N

** Potassium salts crystallized from this solution below 35°F, but salts did not precipitate out until below -4°F

Table 2: Maximum rate of boron as *Solubor* applied at specified liquid fertilizer rates				
	Fluid fertilizer			
	28% UAN	32% UAN	10-34-0	7-21-7
Fertilizer rate, gal/acre	**lbs of B/acre**			
100	0.4	0.3	1.6	0.8
150	0.6	0.45	2.4	1.2
200	0.8	0.6	3.2	1.6
250	1.0	0.75	4.0	2.0

Note: Some of the maximum boron rates listed above may be higher than the recommended boron rates for specific crops.