Tips on mixing the main water-soluble fertilizers with solutions containing SICO-SRN28 (liquid methylene-urea)

Methods

Fill the barrel with half the desired volume of water; start the agitator; add the prescribed dose of compounds based on SICO-SRN28. Dissolve the other water-soluble fertilizers separately in a bucket. Add this solution of water-soluble fertilizers to the barrel.

Warnings

The order for adding the water-soluble fertilizers is not discriminating provided that certain conditions are observed:

• The pH of the end solution determines the stability of the mixture: values under 7.0 or over 13.0 are to be avoided, except for brief periods of time (momentary or extemporaneous stability); the length of this time depends on the value of the pH. For solutions with highly acid pH (< 5.5) or extremely alkaline (> 13.0) stability is of few hours, while for pH between 5.5 and 7.0 it can reach 24 hours. For these reasons, the optimal pH of the mother solution that you want to distribute should be between 7.5 and 11.0. (All the above-mentioned pH values and the following examples refer to solutions as they are).

• The addition of ferrous sulphate always causes the formation of iron hydroxides that precipitate making the solution unstable.

• Avoid using concentrated water-soluble fertilizers with an acid reaction and in such ratios as to determine a sudden drop in pH. For example, concentrated solutions of MAP, MKP and Phosphoric Acid can cause precipitation after a few hours if they are in quantities greater than or equal to the quantity of SICO-SRN28 in the end solution.

• The addition of phosphates to fertilizers containing magnesium lead to the formation of precipitates that make the solution unstable: for instance MAP + magnesium nitrate (formation of phosphates of magnesium).

• The main water-soluble fertilizers for agricultural use, because of the impurities they contain, when dissolved in water can give rise to the formation of deposits or make the solution opalescent; this doesn't jeopardize the stability of the mixture. For the following tests and examples non-polluting fertilizers with a good degree of purity have been used.

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Table 1 - Compatibility of SICO-SRN28 with the main Water-Soluble Fertilizers

Legend: C = compatible L = limitedly compatible X = not compatible

				SICO-SRN28 : water soluble fertilizer					
SICO-SRN28 + Water-Soluble Fertilizers				Weight ratio (p/p) 2 to 1		Weight ratio (p/p)1 to 1		Weight Ratio (p/p) 1 to 2	
Water-Soluble Fertilizer	Contents	Recommended solubility (g/100 g of H_2O) at 20° C	pH of water solution at the recommended concentration	Stability	pH on as is	Stability	pH on as is	Stability	pH on as is
Urea	46.0.0	66	9.3 sub alkaline	C	9.8	C	9.4	C	9.2
Phosphoric acid	0.61.0	25	1.0 highly acid	X	3.8	X	3.1	X	2.5
Monoammonium phosphate **(MAP)**	12.61.0	25	4.1 acid	L	6.4	L	5.9	L	5.2
Monopotassium phosphate **(MKP)**	0.52.34	18	4.3 acid	L	6.9	L	6.4	L	5.8
Dipotassium phosphate	0.40.54	25	9.2 sub alkaline	C	10.1	C	9.9	C	9.7
Potassium nitrate	13.0.46	20	7.5 neutral	C	10.0	C	9.9	C	8.3
Magnesium nitrate	11.0.0 +16MgO	185	6.0 slightly acid	C	8.3	C	7.7	C	7.5
Potassium sulphate **(SOP)**	0.0.51	8	6.5 neutral	C	10.4	C	10.3	C	10.2
Ferrous sulphate	20Fe	20	2.5 highly acid	X	< 3	X	< 3	X	< 3
Ammonium sulphate	21.0.0	40	5.8 sub acid	C	8,6	C	8.5	C	8.2
Calcium nitrate	15.0.0 +25CaO	120	3.0 highly acid	C	8.4	C	7.9	C	7.6
Potassium carbonate	0.0.68	75	> 13 highly alkaline	L	> 13	L	> 13	X	> 13

As seen in table 1 some fertilizers are limitedly compatible. This limitation is due to the ratio with which they are used (with low ratios they can remain stable).

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**Example of preparing a solution between
SICO-SRN28 plus WATER-SOLUBLE FERTILIZERS**

Table 2

	quantity (grams)	pH (on the as is)	Stability of the solution	Notes
SICO-SRN28	500	9	**stable**	Clear
+ addition in sequenze of the following water-soluble fertilizers				
Solution of potassium sulphate **SOP**	200	**10.3**	**stable**	Clear
Solution of ammonium sulphate	50	**9.1**	**stable**	Clear
Solution of monopotassium phosfate **MKP**	50	**7.6**	**stable**	Clear
Solution of urea	50	**8.1**	**stable**	Clear
Solution of potassium nitrate	50	**8.2**	**stable**	Clear
Solution of monoammonium phosfate **MAP**	50	**7.5**	**stable**	Clear

Table 2 shows how the addition of the various water-soluble fertilizers in the stated quantities creates no problems of stability for the end solution to distribute (pH between 7.5 and 10.3).

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Table 3

	quantity (grams)	pH (on the as is)	Stability of the solution	Notes
SICO-SRN28	100	9	**stable**	Clear
+ addition in sequenze of the following water-soluble fertilizers				
Solution of magnesium nitrate	200	**7.7**	**stable**	Clear
Solution of potassium nitrate	100	**8.3**	**stable**	Clear
Solution of potassium sulphate	100	**8.6**	**stable**	Clear
Solution of ammonium sulphate	100	**7.6**	**stable**	Clear
Solution of urea	100	**6.9**	**stable**	Clear
Solution of monopotassium phosfate **MKP**	100	**5.8**	**unstable**	Cloudy

Table 3 shows how the addition of the water-soluble fertilizers to the solution of SICO-SRN28 can significantly change the pH of the end solution. When the pH falls under 7.5 or exceeds 13, the solutions tend to become unstable, creating problems for distribution (crystalline, muddy precipitates, flocculations, etc.).
In the example shown, the addition of the sixth component lowers the pH to 5.8 thereby jeopardizing the stability of the end mixture.

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Table 4

	qunatity (grams)	pH (on the as is)	Stability of the solution	Notes
SICO-SRN28	500	9	**stable**	Clear
+ addition in sequenze of the following water-soluble fertilizers				
Solution of magnesium nitrate	200	**8.3**	**stable**	Clear
Solution of ammonium sulphate	50	**8.2**	**stable**	Clear
Solution of monopotassium phosphate MKP	50	**6.0**	**unstable**	Cloudy

Table 4 highlights how solutions of water-soluble fertilizers added to SICO-SRN28 doesn't jeopardize the stability of the compound until the third component, the monopotassium phosphate (MKP). The solution becomes unstable giving rise to crystalline precipitates that would make distribution impossible with the spraying equipment (obstruction of filters, nozzles etc.).
In this case there is the conjunction of two factors that jeopardize stability:
1) The addition of phosphates to the solution containing magnesium, which generates the formation of insoluble phosphates of magnesium;
2) The MKP, having a highly acid reaction, lowers the pH from 8.2 to 6.0 making the solution unstable.

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Compatibility of the main water-soluble fertilizers for agricultural use in preparing concentrated solutions

Legend: C = compatible X = not compatible L = limited compatibility

	(SICO-SRN28)	Urea	Ammonium Sulphate	Calcium nitrate	Phosphoric acid	Monoammonium ph.	Monopotassium ph.	Potassium nitrate	Magnesium nitrate	Potassium sulphate
(SICO-SRN28)		C	C	C	L	L	L	C	C	C
Urea	C		C	C	C	C	C	C	C	C
Ammonium Sulphate	C	C		L	C	C	C	L	C	C
Calcium nitrate	C	C	L		X	X	X	C	C	X
Phosphoric acid	L	C	C	X		C	C	C	X	C
Monoammonium phosphate	L	C	C	X	C		C	C	X	C
Monopotassium ph.	L	C	C	X	C	C		C	X	C
Potassium nitrate	C	C	L	C	C	C	C		C	C
Magnesium nitrate	C	C	C	C	X	X	X	C		C
Potassiumsulphate	C	C	C	X	C	C	C	C	C	

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Physical-chemical compatibility tests on liquid SICO-SRN28 (SICO-SRN28).

Compatibility with Potassium Nitrate

Starting from a soluble salt (potassium nitrate) and in consideration of the high content of dry matter of SICO-SRN28 it has been necessary to check its compatibility with a solution of potassium nitrate.
Wishing to create extreme situations a solution has been made close to saturation at 20°C dissolving 30 grams of potassium nitrate in 100 cc of water so as to have an end solution with the concentration [C] of 23% of potassium nitrate.
Using this solution some mixtures were made with SICO-SRN28 in the following ratios stated in the table:

SICO-SRN28 ratio: Solution of Potassium Nitrate at 23% of [C]	
1:1	Content NK 15.5 5.3
1:3.67	Content NK 8.4 8.3

No kind of incompatibility has occurred.
Considering that at a practical level more diluted solutions of potassium nitrate are used, it can be stated that there are no incompatibilities (under normal operational conditions on the field) with solutions based on potassium nitrate.

Compatibility with Urea

Starting from a soluble chemical compound (urea) and in consideration of the high content of dry matter of SICO-SRN28 it has been necessary to check its compatibility with a solution of urea.
Wishing to create extreme situations a solution has been made close to saturation at 20°C dissolving 30 grams of urea in 100 cc of water so as to have an end solution with the concentration [C] of 23% of urea.
Using this solution some mixtures were made with SICO-SRN28 in the following ratios stated in the table:

SICO-SRN28 ratio: Solution of Urea at 23% of [C]	
1:1	Content N 21.1 of which 11.1 N-UR and 10 N-MU

No kind of incompatibility has occurred.
This confirms there are no problems of miscibility between diluted solutions of urea with methylene urea.
Considering that at a practical level more diluted solutions of urea are used, it can be stated that there are no incompatibilities (under normal operational conditions on the field) with solutions based on urea.

Compatibility of SICO-SRN28 with water

SICO-SRN28 can safely be diluted with water adding it first followed by water or vice versa that the chemical physical characteristics of stability of the solution don't change, with no precipitates or floccules.

Compatibility with Potassium Thiosulphate

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As they are two liquid products they were mixed directly without adding water to exasperate the operational conditions and verify their miscibility and compatibility in the best way.
Some mixtures were made with SICO-SRN28 in the following ratios stated in the table:

SICO-SRN28 ratio: Potassium thiosulphate	
1:1,12	Content NK 13.2,13.2
1:2,67	Content NK 20.4,6.8

No kind of incompatibility has occurred.
Considering that with the addition of water the components are diluted, aiding their miscibility, it can be stated that at a practical level, using more diluted solutions, there are no incompatibilities (under normal operational conditions on the field) with solutions between methylene urea and potassium thiosulphate.

Compatibility of SICO-SRN28 with iron chelate EDDHA/DTPA

For the first test SICO-SRN28 was taken as is and 5 grams of chelate were dissolved in 100 grams of SICO-SRN28. As SICO-SRN28 is very viscous with a high density and dry matter, the chelate remained on the surface not "wetting," after agitating the chelate dissolved entirely in the SICO-SRN28, leaving no deposits. Since at an operational level a dilution of SICO-SRN28 is used and the chelate is first "dissolved or solubilized" in water and then poured into the barrel containing the SICO-SRN28, it can be stated that there are no incompatibilities at an operational level with the iron chelates EDDHA/DTPA.

Subsequently, 10 g of chelate were solubilized in 100 g of solution in the various mixtures with potassium nitrate, potassium thiosulphate and urea (previously tested). To obtain correct solubilization after pouring the chelate, it was lightly agitated.
In none of the combinations were there any instances of physical incompatibility with formations of precipitates.
Considering that at a practical level more diluted solutions will be used, it can be stated that there are no incompatibilities (under normal operational conditions on the field) with the above-mentioned solutions of iron chelates EDDHA/DTPA.

Using solutions of SICO-SRN28 in combination with iron chelates EDDHA/DTPA for spreading on the ground it is recommended to administer the solution obtained immediately after the components come into contact or solubilize so as not to incur any dissociation of the iron chelate: under all operational conditions the pH of the solution did not exceed the values that could lead to a dissociation of the chelate with its loss of agronomic effectiveness.
Another tip to follow is to load the barrel containing the SICO-SRN28, concentrated or diluted with water, according to the various operational needs, with the iron chelate not as is but previously "dissolved or solubilized" in a small bucket keeping the solution in the barrel lightly agitated. Depending on the nitrogen content of the SICO-SRN28 it is not necessary to solubilize the ammonium sulphate or other types of nitrogenous fertilizer to activate the action of the iron chelate.

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