Petition Addendum No. 3.

Petitioned substances: Chelate ligands: ammonium glycinate and ammonium citrate.

Date of submission of amendment: 16 November 2016.

Attached is a Table showing wheat yields achieved in a field-trial carried out in a zinc deficient soil with a soil pH 7.5.

The point of the Table is to demonstrate convincingly:

- that simple sulphate salts are ineffective in 'delivering' trace metal nutrients to plants in high pH soil.
- that the chelates used in the trial (based on the ligands in our Petition) cause an increase in wheat yields, the increase being statistically significant at the 5% level in an 'analysis of variance' based on random allocation of test plots.

Parameters describing the field trial are:-

(1).
Zinc sufficiency/deficiency was measured using the DTPA-extraction method; this showed 'available zinc' at 0.19 milligrams of zinc per kilogram or 0.19 parts per million (ppm); this result is significantly below the one (1) ppm zinc level that is 'sufficient' for healthy plant growth.

(2)
The trial variable was ONLY the source of zinc.

(3)
Experimental design of the trial was based on the following:-
- a 'control' plot was used where no zinc was added
- six (6) trials were established where zinc was added at six (6) different levels of zinc ranging more than 10-fold from 130 grams per hectare to 1,500 grams per hectare.
- a trial was established where zinc was added as a zinc chelate and where the ligands in the chelate were both of the ligands shown in our Petition, hence the use of the term 'binary chelate'.

There were thus 8 separate trials within the overall experiment.
There were four (4) replications for each trial making a total of 32 separate measurements of yield.
These 32 trial plots had 'random block allocation'.

(4)
Benefits are exactly as predicted from theory:-
- chelated zinc provides a yield increase over the control and over the simple zinc sulphate; most importantly, the yield increase is statistically significant at the 5 % level.
- simple sulphate salts do not work in high pH soil, irrespective of the amount of trace-metal added per hectare, even over a 10-fold range of zinc sulphate addition.

The relevance of the trial for NOP and NOSB and for our Petitions is:-
- proof that ‘Solubility Product Laws’ from inorganic chemistry apply in broad acres as well as in a test tube.
- proof that our ligands - the subject of our Petitions - actually form a real chelate using the already NOP-approved zinc sulphate as the source of zinc nutrient.
- proof that chelates from organic chemistry - 'organo-metallic-complexes’- when added to high pH soil, do act in a protective manner, preventing ionic zinc - and other ionic trace metals- from being precipitated thereby becoming useless as a source to plants of nutrient-trace-metal.

Over the last 5-6 years, the Petitioner has personally spent financial sums equivalent to two (2) around-the-world month-long holidays in obtaining the field trial results shown in the Table, and in other field trials.
Not surprisingly, because the professionally planned and executed trials - run by qualified third parties - show positive results for chelates, the petitioner is strongly promoting the clearly defined benefits which chelates possess and which are, in any case predicted from theory.

Conversely:-

The NOP and NOSB version of a ligand, which OMITS an alkali and hence OMITS an acid neutralisation step:-
- cannot and does not form a chelate, and accordingly,
- does not offer any benefits to organic-certified producers.

There is an error in NOP’s documentation on ligands, which, without prompting from external parties such as myself, will not be corrected.
The error is in the statement that ‘citric acid’ is a chelating agent.
It is not.
An acid cannot act as a chelating agent.
Only the salt of citric acid can act as a chelating agent or ‘ligand’.
A ligand is NOT added to soil, as assumed by the Crops Subcommittee.
A ligand is a salt and this once reacted with another salt - already approved by NOP - forms a ‘double salt’ - a ‘chelate’ - and it is this chelate which is added to soil - which is what is shown in the attached Table.

The writer appreciates the intentions of the Crops Subcommittee in wanting to preserve the integrity of organic-documentation.
But it would be better to have their energy and determination backed up by correct chemical theory.
Instead of flying an organic Standard, they are left to march under a ragged banner.

Mean yields and zinc concentrations in wheat grown with different zinc fertilisers and rates of application. The zinc binary chelate row is highlighted in dark green.

Field site near Loxton, SA; soil pH: 7.5; DTPA Zinc: 0.19mg/kg (=ppm)

Treatment	Establishment, plants per sq m	Zn in YEBs at tillering, mg/kg*	Zn in YEBs after foliars applied, mg/kg*	Shoot DM after foliars applied, g per 20 plants*	Grain Yield, t/ha*
Nil Control	80	17.3		10.6	1.80 [a]
Sulphate: Fluid at seeding (0.13 Zn kg / ha)	74	17.5		11.5	1.70
Sulphate: Fluid at seeding (0.25 Zn kg / ha)	70	20.0		11.8	1.84 [ab]
Sulphate: Fluid at seeding (0.5 Zn kg / ha)	62	21.0 [a]		12.5	1.83 [a]
Binary chelate: Fluid at seeding (0.5kg Zn/ha)	67	23.5 [a]		10.8	1.93 [b]
Sulphate: Fluid at seeding (0.75 Zn kg / ha)	66	19.5		11.0	1.73 [a]
Sulphate: Fluid at seeding (1.0 Zn kg / ha)	66	16.3		11.8	1.78 [a]
Sulphate: Fluid at seeding (1.5 Zn kg / ha)	75	24.7 [a]	21.0	10.5	1.84 [ab]
p value	*0.49*	*<0.01*	*<0.01*	*0.55*	*<0.01*
LSD (p=0.05)	-	*3.2*	*2.3*	-	*0.09*

* Means in the same column with the same letter beside them are not statistically different from the binary chelate value with the same letter.