**How WakeUP increases foliar-applied trace element absorption and translocation in crops: Four years of data**

These charts summarize dozens of tissue tests showing that WakeUP increases efficiency of foliar nutrient sprays on every crop we’ve tested. WakeUP does four jobs to make that happen:

1. Reduces surface tension, so spray solutions clear-coat the entire leaf surface
2. Temporarily softens the waxy cuticle of the leaf, opening it to nutrient absorption
3. Gently chelates nutrient elements and carries them into the phloem circulation system
4. Eases surface tension in plant sap, making nutrients easier to pump out of leaves

**In 2013, we developed a new formulation** to replace the “old reliable” WakeUP 1, which has been used worldwide several years and also known as Soysop 1. We named our new product WakeUP Summer and labeled it as a surfactant.

After a wide range of tissue tests, we believe we’ve found the optimum balance of surface tension reduction, chelating effect and leaf surface softening. Each of these benefits, we found, can be overdone.

Compared with the previously best surfactant we know, our tests show that WakeUP Summer consistently moves more trace elements and other foliar-applied products into crops than WakeUP 1 (Soysoap 1 did).

We are also working on another formulation known as WakeUP Fresh, a more gentle cleanser and surfactant for vegetables.

**Trace element content of corn at V3, 48 hours after foliar spraying with trace elements in three types of colloidal micelle surfactant / carriers**

Absorption and translocation of manganese rose 200% with WakeUP Summer as carrier, compared to control. Zinc content rose almost 300%.

These tests were done in early 2013 with our new formulations.

**Trace element content of corn at V5, after foliar spray with Defender G, with and without tank-mixing with WakeUP Summer as surfactant/transporter**

Percentage values indicate analysis in parts per million with 2-pint rate plus WakeUP Summer, compared with untreated control.

Corn in this greenhouse trial in early 2013 was about two feet high. The additional maturity and different hybrid led to different control levels of key elements. However, the results of adding WakeUp were the same in both maturities of corn: WakeUP in the tank mix enhanced absorption and translocation of foliar-applied nutrients. Doubling the application rate of Defender G showed a step-up in tissue analysis of every element.
Winter wheat has smooth leaves which have always responded dramatically when we’ve added any WakeUP blend to foliar mixes.

Our next foliar testing goal is to take samples every three days after application, to plot the “curve” of micronutrient absorption by the crop. That should give us a clearer idea of how fast any deficiency might re-occur if the crop is having difficulty extracting enough micros from the soil.

The test at right was after a foliar spray at regular rates of Defender G from FHR Farms. This is one of the blends we’ve had extensive experience with, and typically benefits from tank-mixing with WakeUP Summer.

Trace element content of winter wheat leaves, 48 hours after foliar spray with trace elements in two formulations of WakeUP

Absorption and translocation of manganese rose 200% with WakeUP Fresh as carrier, almost 400% with WakeUP Summer as carrier, compared to no application.

In our greenhouse, we tested several kinds of leafy crops with a variety of foliar micronutrient blends. In almost every case, the rate of trace element absorption rose with WakeUP Summer in the spray solution.

Soysoap 1 remains a close second, and we continue to recommend using it, as it’s superior to the diluted versions of colloidal micelle products on the market.

WakeUP Fresh is a “beta” product we’re testing in cooperation with a firm which has 20 years’ experience in colloidal micelle technology, GEMTEK of Phoenix, Arizona. Currently, WakeUP Fresh is out on field trials in several Southeastern states.

WakeUP Summer is designed to react with water, making it easier to pump through the tiny phloem tubes and sieve cells at the connecting points between phloem tubes.

WakeUP builds nano-sized “micelles” from water molecules. These micelles form temporary bonds with nutrients and other compounds in the spray solution.

WakeUP also has a lubricating effect in plant circulation systems, making plant sap easier to pump through the circulation system from leaves to roots. You may also notice that “easier to pump” response in your field sprayer, if it has a computerized flow control. Add WakeUP and the required pressure to deliver a constant rate may drop 2 to 4 pounds. Your spray solution moves more easily through spray tips.

We recommend using tips that deliver a mid to large droplet size, as big drops with WakeUP in them will clear-coat leaves smoothly. And we recommend 2 to 4 lbs. of sugar (we prefer dextrose or good molasses) per acre to encourage leaf-dwelling PPFMs, the bacteria which generate cytokinins, which are growth stimulants.
Trace element content of corn after foliar spraying with trace elements in water and WakeUP, with and without "structured" or magnetically treated water

Absorption and translocation of manganese and zinc more than doubled with WakeUP Summer as surfactant and carrier, compared to control, or nutrients applied in water alone. Structuring water or magnetically treating water did not improve absorption and translocation relative to WakeUP alone.

In 2012 and before, our tissue testing with WakeUP was based on formulations by Biobased USA of North Carolina. Those formulations are still available from Biobased, trademarked as Soysoap 1 and Soysoap 2.

The chart at right is the result of tank-mixing Defender G + with the Biobased formula now known as Soysoap 1. Some tissue tests have shown an even more pronounced result with Defender G trace mixes.

We consider it a benchmark product when we test some new ‘flavor’ of WakeUP built in our lab.

Micromix is another widely used trace element blend, and we tested it on corn in 2012 using WakeUP 1, the predecessor to WakeUP Summer.

It showed the usual increase in mobilization of traces, except for Zinc. Obviously, the levels of each trace element in the product impacts the readings you’ll find in the crop after application. Probably the most needed traces, especially in a glyphosate environment, are manganese and zinc.

Foliar Blend is a widely used foliar product with proven yield response.

However, that yield response is primarily due to growth promoters in the product other than the “trace elements” such as manganese, zinc and iron.

Note in this tissue test that there wasn’t much change in elements found in the leaves after an application of Foliar Blend. That doesn’t mean yield isn’t impacted, though.

Trace element content of corn leaves foliar-fed Micromix with and without WakeUP 1

Tests conducted at Cedar Falls, IA by Renewable Farming LLC for crop consultant Bob Streit, Boone, IA
Samples taken July 18, 2012.

Trace element content of winter wheat growth sprayed May 2 with Foliar Blend trace elements, with and without WakeUP surfactant/transporter.
Samples taken 5/23/2011 at average 14 inch height

This test was in spring 2011 with wheat at boot stage

Percentages show increase of each element over control
Percent change in soybean pod analysis in trace elements, DiHoMa foliar with and without WakeUP

Test on soybean pods sampled Sept. 14, 2011, with most pods almost filled. About two-thirds of dry matter was soybeans in the pods. This is an effort to measure translocation from leaf application into the "fruit" or seed structure.

Average nutrient increase for all five elements with WakeUP tank-mixed to foliar micronutrient spray: 25%.

<table>
<thead>
<tr>
<th>Element</th>
<th>DiHoMa alone</th>
<th>DiHoMa + WakeUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>0.3%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Manganese</td>
<td>8.2%</td>
<td>9.0%</td>
</tr>
<tr>
<td>Boron</td>
<td>9.0%</td>
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<tr>
<td>Copper</td>
<td>36.4%</td>
<td>52.3%</td>
</tr>
<tr>
<td>Zinc</td>
<td></td>
<td>39.5%</td>
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One of the “richest” trace element mixes we’ve tested was custom built for us by Ray Faulk, owner of DiHoMa Chemical, 142 Drew Road, Mullins, South Carolina. Ray is a longtime chemist, and also a farmer. The blend he formulated laid down well on crops by itself, and clear-coated even better with WakeUP. We worked at distributing it here in the Midwest, but shipping logistics pushed its cost a bit past the local competitors.

WakeUP Summer plus Kugler 2075 foliar fertilizer, plus 4 lbs. per acre of dextrose, leaves corn gleaming like it has been waxed to a high sheen. Our program is a little bit of foliar nutrition about every two weeks, always applied in the cool of early morning.
WakeUP helps mobilize foliar-applied nitrogen, adds almost 12 bu. per acre to corn yield in this 2010 test

Our foliar-feeding corn trial in Grundy County, IA in 2010 offers more evidence that extended-release nitrogen “spiked” with WakeUP can improve a good corn yield by almost 12 bu. per acre.

The yields in the chart at right are averages of four 8-row strips, each 2,300 feet long. The two treatments were 1 gal per acre of Kugler’s KQ-XRN 28% nitrogen, with and without WakeUP.

Foliar-applied nitrogen alone showed a 6.8-bu. yield increase over the untreated control strips.

When WakeUP was tank-mixed with the same rate of nitrogen, strips sprayed with the combination averaged another 5 bu. per acre, hitting 190.2 bushels.

Total yield gain for WakeUP and slow-release nitrogen together: 11.88 bu. per acre. WakeUP cost: $6.05 for 5 ounces per acre. Nitrogen cost: $7.45 per acre. Add $5 for application; total was $18.50.

At $4.90 per bu. corn, the net benefit for the WakeUP/nitrogen combination is $40 per acre.

Several fertilizer manufacturers are offering new or improved slow-release foliar nitrogen products. They want to increase consistency of yield improvement under a wide array of conditions. Our field tests show that WakeUP improves leaf coverage, absorption and nutrient translocation in the crop to help achieve consistency.

WakeUP’s mode of action relies on “nano-sized” micelles: less than a billionth of a meter.

WakeUP micelles reduce the “stickiness” of water and increase its solubility, so nutrient solutions flow more easily under osmotic pressure.

We first noticed this type of response when Southern farmers saw how glyphosate spiked with WakeUP killed weeds which have become “resistant” to glyphosate. We reasoned: If WakeUP improves herbicide absorption and translocation, it should also enhance foliar fertilizer efficiency and yield.

Early field trials indicate we’re working with a viable idea. Next, we need to refine rates, fertilizer formulas and application timing for the most cost-effective results.

Here’s how the field looked at application time... and at harvest. Corn from control strips averaged 58 lbs. per bushel. Corn treated with nitrogen alone averaged 57.4 lbs. per bushel. Corn treated with Wakeup and nitrogen averaged 59.2 lbs. per bushel.
Trace element analysis of soybean pods indicates
WakeUP helps mobilize foliar-applied micronutrients

Farmers who raise glyphosate-tolerant corn and soybeans often foliar-feed manganese, boron, zinc and other elements to assure adequate levels in plant tissue.

Crop consultants report that corn and soybeans often have low trace elements. They’re concerned that glyphosate ties up, or chelates, these critical elements.

Dr. Dan Skow, International Ag Labs of Fairmont, MN, says that foliar feeding is a cost-effective way to overcome micronutrient deficiencies. He has seen manganese levels in soybeans as low as 10 parts per million, when 20 to 100 is the desired range.

One way to “encourage” crop leaves to absorb and translocate micronutrients is to chelate or bind them with humic acids, which are complex plant-source compounds readily accepted by crop metabolism. Dr. Dan Skow and a colleague, Dave Larson, pioneered that concept years ago.

A second enhancement for getting micros absorbed and metabolized is to tank-mix them with the surfactant/transporter WakeUP.

The nano-sized micelles in WakeUP bond with micronutrients and make them more soluble in water. This is the “missing link” needed to make foliar nutrients more effective, says surfactant specialist Jerry Pritchard of Coila, MS. He says, “We finally have that missing link. Biobased USA solved it nanotechnology.

Evidence of WakeUP’s effectiveness: Each trace element analysis shown in this chart is the average of seven randomized plots. The test was conducted on beans with glyphosate-tolerant genetics. Seven plots were backpack-sprayed Aug. 3, 2010 with a mix of trace elements alone (analysis in box below). Effective rate was about two pints per acre.

Seven other sites in the same test field were sprayed with the trace mix tank-mixed with Wakeup at 1 part WakeUP to 256 parts of spray solution. The beans were at R6, developing new pods.

Seven unsprayed controls were randomly distributed through the experimental field. Plot design was supervised by Dr. Bertel Schou, owner of ACRES, a research farm.

After two weeks to allow for nutrient translocation into soybean pods, 30 or more pods were pulled from each of the 21 plots and analyzed by Midwest Laboratories of Omaha, NE. Very little of the spray had reached the pods, which were under a full leaf canopy. The trace mix alone showed a 13% gain in pod level of iron, a 22% gain in manganese, a 12% gain in boron and a 71% gain in zinc.

Tank-mixed with WakeUP, the absorption and translocation of traces showed substantially higher levels of all trace elements in pods, compared to the trace mix sprayed alone.

The greatest gain in pod analysis was a 190% increase in manganese, to 151 parts per million. Zinc analysis...
Trace element analysis of winter wheat shows how WakeUP helps mobilize foliar-applied micronutrients

Dr. Dan Skow of International Ag Labs, Fairmont, MN says that foliar feeding crops is the next major opportunity for raising crop yields, quality and profit.

Skow adds that foliars are the most efficient way to correct trace element deficiencies, which are showing up with increasing frequency on soils with a long history of glyphosate application.

Glyphosate, a strong chelating agent, ties up important elements like manganese, copper and zinc.

Field research in 2010 shows that WakeUP — a “nanotech” surfactant and transporter — helps carry foliar-applied elements into crops and through crop circulation systems. Wheat tissue tests at right are one example. This data is the average of four random-rep samples on wheat for each treatment:

1. Trace elements applied alone
2. Trace elements mixed with WakeUP
3. Untreated control

The trace package applied was Defender G4 from BRT Ag & Turf:

Applied alone, the trace mix improved levels of beneficial elements (chart above). Tank-mixed with WakeUP, absorption and translocation of most elements rose substantially. One reason: WakeUP greatly reduces surface tension of water, which improves leaf contact (photos below) and enhances internal translocation of nutrients through crop xylem and phloem systems. WakeUP is also a solvent that softens the waxy cuticle on leaves so nutrient can easily enter plant circulation pathways.

All ingredients in WakeUP are derived from plants, so crops readily absorb and metabolize it.

Very small amounts of WakeUP are needed to “amplify” foliar sprays — just four or five ounces per acre.

Some growers tell us they add three to eight ounces per acre with every spraying trip, from burndown herbicides in early spring to foliar nutrients and fungicides through the summer.

WakeUP applied by itself at the two-leaf stage enhances root growth and drought resistance. And when applied in combination with other products such as foliar nutrients, WakeUP has shown increased absorption and translocation of those nutrients. That makes your foliar fertilizer investment more cost-effective.
On Sept. 16, 2010, we sprayed two 12 ft. x 12 ft. plots of alfalfa with a trace element blend in a tank mix of 1:256 WakeUp and water.

This was intended not as a statistical test, only a screening for effect. The alfalfa was about eight inches high, recovering from a third cutting, and growing vigorously.

In the next 10 days, 2.08 in. of rain fell in three storms, so the alfalfa was thoroughly washed down and most external residual would have been removed.

On Sept. 27, we snipped leaf and stem samples of new top growth from the two treated plots and two untreated controls adjacent to the treated plots on comparable soil.

Samples were sent to Midwest Laboratories, and the averages are shown at right. We can fax the original lab reports to anyone interested.

In this trial, we didn’t apply the trace element pack alone. We’ve seen previous trials where WakeUp amplifies the trace-element analysis, and simply wanted to check out alfalfa’s response to WakeUp together with traces.

We’ve learned with repeated field trials this summer and fall that

 wakes the absorption and translocation of foliar-applied trace elements. This could make foliar application an even more effective management tool for balancing micronutrients in growing crops.

Our next phases of research will focus on optimum levels of traces for cost-effective improvement in test weight, crop health and yield.

In spring 2011 we intend to begin testing several formulations of micronutrients, including those chelated with humic acid and not EDTA or phosphites.

If glyphosate-resistant alfalfa is approved for general use, monitoring of micronutrients will become more essential because glyphosate chelates or ties up micronutrients.

Previous tests of WakeUp on alfalfa in Montana have shown an increase in alfalfa tonnage and relative feed value.

Also, we had a 2009 experiment with unintended consequences in 2010. We rented a small test area on a local farmer’s new seeding of oats and alfalfa. We sprayed WakeUp by itself on the oats and alfalfa, and saw an 8% yield increase in the oats in 2009.

Then this spring, we noticed a taller, thicker regrowth of alfalfa where we had sprayed those test strips in 2009. Apparently the alfalfa seeded with the oats had responded to WakeUp by developing deeper roots, which reflected in faster emergence and regrowth this spring. Alfalfa on treated strips bloomed earlier. The test strips had to be cut and baled separately from the rest of the field. The farmer put up with that, because he had more yield!
Calcium is the “king of nutrients” among farmers who use Renewable Farming principles to build soil biological life and natural fertility.

Calcium is vital for strong cell walls, resistance to insects and disease, and mobilizing other nutrients. But building calcium content in vigorously growing crops has long proven a major puzzle. Soil-applied calcium is taken up slowly.

“Nanotech” calcium — particles of calcium carbonate as tiny as one billionth of a meter — offer an opportunity to enhance calcium content of growing crops. However, getting nano-sized calcium efficiently absorbed and mobilized within the crop remains a challenge.

So we tested two “nanotech” products in one spray mix. In a preliminary trial with three random replications, we found that Lithovit, (a calcium carbonate product with nano-sized particles) raised tissue calcium content of young oats leaves by 19% when sprayed at a rate of 2 lbs. per acre. When Lithovit was tank-mixed with WakeUP, our surfactant/transporter, leaf calcium tests jumped by 34% over controls.

Leaf samples were cut from new growth 11 days after spraying. Oats were about 4 in. high when sprayed, and twice that high when cuttings were taken for analysis.

Only calcium was applied in this test, but several other elements showed increases in the leaves — possibly because calcium enhanced uptake of soil nutrients.

Zinc, not shown in the chart above, rose 10%. WakeUP contains some zinc (It’s registered in Iowa as a micronutrient product).

In other foliar-applied micronutrient tests on alfalfa, wheat and soybeans, the same pattern emerges in tissue test data: The foliar spray alone shows some response, but the levels are substantially enhanced when WakeUP is included in the tank mix.

We use a standard 1:256 ratio of WakeUP concentrate in water. That translates to five ounces per acre of WakeUP concentrate if the total application rate is 10 gal. per acre.

So for a cost of about $6 per acre, WakeUP “amplifies” effectiveness of foliar nutrient sprays such as nano-calcium or a trace element blend.

Calcium and iron are important in building leaf thickness. Dr. Dan Skow of International Ag Labs, Fairmont, MN says: “If you could somehow double thickness of a crop leaf, its photosynthetic capacity would rise by 400%.”

Bottom line: WakeUP can be effective in correcting leaf tissue mineral deficiencies and thus enhancing crop productivity. We have much more research to do, but as one widely respected crop scientist tells us, “This looks promising.”

“Lithovit” is the brand name for a German-manufactured calcium carbonate with particle sizes of about a billionth of a meter. Other manufacturers are attempting to build similar products. At this tiny size, calcium carbonate easily suspends in spray solution. When WakeUP is added to the tank mix, leaves are coated smoothly. The data here indicate that WakeUP improves absorption into the leaf, and translocation through the plant’s circulation system.