Plant biologist Dr Eric Nguema-Ona.

new levels of automation.

Employing 32 workers, the factory produces 64 different products from seashell soil conditioners to biostimulants in everything from 250 ml bottles of liquid to bulk lorry loads of powdered products. The biostimulant workshop produces up to 30 tonnes of product per day, while at full capacity, the fertiliser crushing facility can process 20 to 25 tonnes per hour of fine (160 µm) powder.

One key element is being able to extract the required compounds from the harvested raw materials (such as seaweed, which comes from the largest deposit in Europe) and formulate them into products which maintain their benefits. As you would expect, not only does the factory work closely with the formulation teams at the CMI (as do all TIMAC AGRO's global manufacturing sites), but an on-site laboratory samples and tests both incoming raw materials and finished products.

"We're now a quarter of the way through the 21st century and 80 per cent of our core nutrition is based on 19th and 20th century technology, and excessive use of synthetic fertiliser products has degraded soil life," stresses David Newton. "Yields have plateaued because crops are becoming less responsive to conventional fertilisers as we are killing off soil life and degrading organic matter. With global markets focusing on sustainable production, there has never been a more relevant time for including biostimulant technology into crop production."

As an example of the benefits of biostimulants, he cited a field demonstration on a crop of Nectar potatoes in Cambridgeshire. Four alternate 2 l/ha applications of TIMAC AGRO's Seactiv Gold and Seactiv MagiCal biostimulants were applied to the crop at 10–14-day intervals following tuber initiation. The results, which were verified by Ceres Research, showed fewer but heavier marketable tubers per plant in the treated crop, with an overall 18.7 per cent increase in marketable yield equivalent to 11.4 t/ha. Once the costs of the biostimulant programme were factored in, the treatment increased returns on the crop by £2,736 per ha.

In another trial demonstration near Spalding in Lincolnshire a potato crop treated with Fertiacyl Starter at emergence and three applications of Seactiv Vital following tuber initiation. Yield was increased by around six tonnes per ha, providing an additional £1,538/ha in revenue after product costs. "The application of a TIMAC AGRO biostimulant programme resulted in a yield uplift by encouraging rooting and reducing growth stoppages due to abiotic stress," explained David. "We are getting our results validated by independent organisations.

"Other countries across Europe, as well as countries like Brazil, the United States and Canada are all way ahead of the UK in their utilisation and understanding of where biostimulants fit within a programme," he concluded. "Hopefully this visit has demonstrated that there is science behind biostimulants." ◆

Last year's wheat is eating this year's vegetable crop

Every autumn combines leave behind somewhere between four and eight tonnes of straw per hectare, sometimes this is baled and removed, but oftentimes it is not.

The textbooks say incorporate it: build organic matter, improve soil structure, sequester carbon.

Tick all the boxes.

So, we chop it, we plough it in, we feel virtuous - and then wonder why the following crop comes up yellow, patchy and two weeks behind schedule writes Simon Fox, Soil Scientist at Emerald Research.

The problem is chemistry and it's not complicated. Wheat straw has a carbon-to-nitrogen ratio of roughly 80:1. Barley is even higher. Soil microbes need a C : N of about 20:1 to break organic matter down efficiently – less in some cases. To close that gap, they do what any sensible organism does - they scavenge. Every available scrap of soil mineral nitrogen gets hoovered up by microbes working through the straw, leaving the next crop staring at an empty cupboard. The rule of thumb is seven to nine kilograms of supplemental nitrogen per tonne of incorporated straw. On a heavy straw yield, that's 50 to 70 kg N/ha of immobilisation before your crop has even germinated.

And that's just the nitrogen. Physically, poorly incorporated straw creates air pockets in the seedbed that disrupt root-to-soil contact, interfere with capillary rise and make establishment erratic - especially for small-seeded crops like carrots, onions and brassicas. For potatoes and module-planted crops, undecomposed straw around seed tubers or transplant plugs slows early root development at exactly the moment it matters most. Disease organisms survive and multiply on buried residues: fusarium, rhizoctonia and a menagerie of fungal pathogens that would rather live on dead straw than face the open soil.

Then there's the greenhouse gas question - the one the carbon sequestration advocates prefer not to dwell on. A recent meta-analysis found that crop residue incorporation increases soil N_2O emissions by roughly thirty per cent compared to residue removal. The microbes decomposing straw consume oxygen, create anaerobic micro-sites and drive denitrification - converting the very nitrogen they've immobilised into nitrous oxide, a greenhouse gas three hundred times more potent than CO_2.

So, we're told to bury the straw to sequester carbon, while the process of decomposition releases both CO_2 and N_2O. Whether the net carbon balance is positive depends on soil type, temperature, moisture and management - but it is nowhere near as straightforward as "straw in, carbon stored."

Not all crops cope equally. Heavy feeders like potatoes - hungry for nitrogen, sulphur, micronutrients and soil oxygen around the tuber - are the worst candidates to follow freshly incorporated straw. Carrots and onions suffer from the physical disruption. Legumes, which fix their own nitrogen and are less dependent on soil mineral N, tolerate it far better. If a high-value, high-demand crop is next in the rotation, removing the straw is not laziness - it's common sense.

What can you do? Chop finely - double-chop if possible. Smaller particle size massively increases the surface area available to microbes and speeds decomposition. Apply a fast-release nitrogen source at or just before incorporation: 8 kg N per tonne of straw is a reasonable starting point. Incorporate early, into warm, moist soil - microbes barely function through winter, so autumn-incorporated straw in cold, wet conditions will still be sitting there in March. And if you're following cereals with a high-value vegetable crop, consider whether removing the straw and applying it elsewhere might be cheaper than managing the consequences of leaving it.

Building soil organic matter is a long game. Starving this year's crop to feed a theory is not a strategy. ◆