Azotic Technologies’ natural nitrogen fixing technology (N-Fix®) is a disruptive innovation which has the potential to totally transform agriculture. N-Fix® provides a sustainable solution to fertiliser overuse and nitrogen pollution as well as improving plant efficiency and increasing yields.
The Company

Azotic Technologies Ltd was established in January 2012 to develop and commercialise a natural nitrogen fixing technology which enables sustainable farming without nitrogen pollution. This technology is unique to Azotic. It is patent protected, providing proof of concept and enabling commercial development. Azotic has a highly experienced management team with a very strong track record in international agriculture.

Management Team

The management team of Azotic Technologies have proven experience in the development and commercialisation of new technologies within agriculture. Our combined expertise will benefit the advancement and marketing of Azotic’s natural nitrogen technology which is designed for our 21st Century needs in agriculture.

The founders of Azotic Technologies Ltd are:

Peter Blezard – Chief Executive
- Fellow of the Royal Society of Arts
- Founder and Former CEO of Plant Impact Plc
- Strategic focus on sustainable agriculture
- Highly experienced in pioneering products into new markets
- Extensive background of working with major companies on a global basis at board level
- Responsible for commercial issues, business development and sales

Mike Panteli – Chief Financial Officer/Chief Operations Officer
- Chartered Management Accountant
- ACCA Diploma in International Financial Reporting
- Former Financial Controller of Intercytex Group Plc
- Former CFO of Plant Impact Plc
- Experienced in getting companies trading on AIM
- Responsible for financial management and operations

Dr David Dent – Technical Director
- A scientist with over 30 years’ experience in agriculture
- Special Advisor to the Parliamentary and Scientific Committee
- Manager of the £12 million LUBILOSA Programme in Africa
- Former Managing Director of CABI Bioscience
- Chief Executive and principal consultant of Dent Associates Ltd
- Responsible for R&D, product development and other technical matters

Allen Sheena – Marketing Director
- BA (Hons) in Business Studies
- Experience includes strategic market development, market intelligence and public relations
- Spent eight years as Marketing Consultant with Irish Trade Board
- Formed specialist marketing consultancy in 1988
- Former Marketing Director of Plant Impact Plc
- Responsible for the management and implementation of Azotic’s marketing activities

Adriana Botes – Commercial Formulation Development
- Experienced R&D Director operating at the technical/commercial interface in senior management roles in SME and corporate environments.
- A proven track record of designing, implementing and managing strategic, multi-disciplinary research programmes to develop innovative platform technologies and products in academic, research institute, SME and corporate environments.
- Extensive experience in the establishment and coordination of research collaborations between industry and academic/SME/contract research organisations, the negotiation of R&D contracts and the design and creation of Intellectual Property portfolios.
- Director of Videra Services Ltd; CSO & Cofounder of VideraBio (a trade name of Videra Services Ltd). Videra Services Ltd provides consultancy services (technical, strategic, FTO & SOTA, competitor analysis) to SME’s, Corporate, VC funders, CRO & RO clients.
- Former R&D Director at INVISTA (6 years), R&D Director & Co-founder of Oxyrane (5 years), Research Fellow at CSIR (South Africa) & Academic roles (University of the Free State, Senior lecturer & PI).
Azotic North America

Azotic North America is responsible for commercialisation in the US and Canada, under the brand name of Envita. The Envita Growing Programme is being carried out across 2,500 acres involving 58 farmers growing either corn or soya bean. Feedback from the growers and the initial results from these trials are extremely encouraging.

Koppert Biological Systems

In 2014, Koppert Biological Systems became an investor in Azotic Technologies. The two companies work closely to drive commercial development of N-Fix. Koppert is now a significant shareholder.

Nitrogen fixation with beneficial bacteria

Nitrogen fixation is the natural biological process, by which nitrogen (N₂) in the atmosphere is converted into ammonia (NH₃). Humanity depends on fixed nitrogen to fertilise croplands and helping nature in relation to nitrogen availability is a key aspect of world food security.

Nitrogen fertilisation is a requirement of modern agriculture to increase crop productivity, however the majority of current products are inefficient in application and uptake by plants. These products and current practices are now environmentally unsustainable in the volumes that are being applied. The application is increasingly expensive, and the excess nitrogen chemically binds with other elements in the environment to create pollution that fouls the water and air.

Symbiotic Nitrogen Fixation

The commercial success of the Haber-Bosch process for nitrogen fixation has delayed the development of any biological nitrogen fixation alternative. The search for a better, cheaper, and more environmentally friendly way to fix nitrogen was unsuccessful until now. The discovery of the non-rhizobial nitrogen-fixing bacterium Gluconacetobacter diazotrophicus (Gd) is an endophytic bacteria that actually works.

The development of this natural nitrogen fixing technology was initiated by Professor Edward Cocking FRS, director of The University of Nottingham’s Centre for Crop Nitrogen Fixation, who discovered a specific strain of nitrogen-fixing bacteria in sugar-cane, which he found could intracellularly colonise all major crop plants. The University has a strong track record in developing new technologies through collaboration with members of the industry and its renowned Plants and Science division is acclaimed as centre for fundamental and applied research. Also, the University has a strong global presence, with campuses in China and Malaysia.

Azotic’s N-Fix technology has the following features:

- It can provide approximately 50% of the plant’s nitrogen needs.
- Increases crop yield
- Enhances crop quality – improves protein levels
- Supplies a clear market need at an advantageous cost benefit to farmers.
- It contains no toxins and is environmentally friendly.
- Less nitrogen pollution from reduced nitrogen fertiliser usage.
- A sustainable product which improves agricultural productivity.
- It allows the bacteria to potentially colonise every plant cell.
- It is neither genetic modification (GM) nor bioengineering.

N-Fix Technology

Azotic’s N-Fix technology is based on a beneficial bacteria Gluconacetobacter diazotrophicus (Gd) for coating plant seeds in order to create a symbiotic relationship within the plant enabling it to substitute the nitrogen it normally takes up from the soil with atmospheric nitrogen – thus reducing dependency on nitrogen fertilisers.

Gd is a food grade bacteria which is derived from sugarcane. This nitrogen-fixing bacteria (N-Fix) is a patented disruptive technology which will have a huge impact on agriculture – the bacteria fixes nitrogen intracellularly within crop plants.

Azotic’s unique N-Fix technology enables plants to extract their own nitrogen from the atmosphere. The technology is applied to the seed and spreads systemically through the plant, enabling the organism to form a symbiotic relationship with the Gluconacetobacter diazotrophicus (Gd) bacteria that converts atmospheric nitrogen into a form that the plant can use.

Azotic scientists have extended the company’s patent portfolio for the Gd technology beyond the family of patents taken out by the University of Nottingham.

Azotic has:

- Full patent coverage in UK, Europe, USA and Canada relating to Gluconacetobacter Diazotrophicus – 2 patents granted.
- Four new patent applications filed and at a mature phase – 20 years patent protection globally.
- A dynamic pipeline – development of new IP & new patents.

In all instances, the applications contain data showing proof of principle of the inventions claimed.
Trade Marks

Azotic is a registered trade mark in USA.

N-Fix®
Registered as a trade mark on 4th July 2012.

envita
Product name registered in the USA by Azotic North America

Critical Issues

Food security, nitrate fertiliser overload and nitrogen pollution are all critical issues.

Global food production must double by 2050 in order to feed a growing world population. More efficient farming is required to increase food supply.

In agriculture, Nitrates are added in vast quantities to increase crop productivity; this is a very inefficient process with approximately 70% of nitrates applied on the land lost to the environment.

Nitrogen leached into the atmosphere and waterways can have serious detrimental environmental effects. Dead zones affect many ocean areas and waterways. Nitrate contamination in groundwater affects drinking water and can adversely affect human health.

Agricultural run-off into the earth’s oceans, soils and atmosphere has adversely affected the earth’s nitrogen balance. Also, the release of Nitrous Oxide is essentially a greenhouse gas.

Market Needs

- All plant cells need nitrogen – Nitrogen fertiliser is currently the foundation for this.
- Current level of nitrogen fertiliser use cannot continue – Governments will introduce more stringent regulations on nitrogen fertiliser use.
- Atmospheric nitrogen is locked-up – new technology is desperately needed.
- N-Fix is the key to unlocking atmospheric nitrogen.
- The agricultural industry is now focusing on biologicals.

Sustainable agriculture will depend on the greater use of biological nitrogen fixation at a time when more food is needed to feed an increasing population.

Field Trials

Intracellular colonisation and nitrogen fixation has been proven to work in the laboratory and through field trials. Azotic’s initial product N-Fix, a liquid seed inoculant, has been tested and validated by external contract research organisations (‘CROs’). N-Fix’s efficacy has been proven on key crops such as maize, wheat in the UK, USA, Canada, Germany, Belgium, France and Spain and rice in Vietnam.

The field trials have proven that N-Fix has the capability of:
- Saving chemical nitrogen fertiliser applications
- Increasing grain yield
- Improving grain quality

Rice trials in Vietnam

Results with Gd at direct sowing

The graph below presents an average of two trials with direct sowing. Result is an increase in yield of 22% when Gd was used at 100% fertilisation level. When the nitrogen level was decreased to 50 – 60% an increase in yield with 33% was observed.

Results with Gd at transplanting

The graph below presents the results of one trial with transplanting. Result is an increase in yield of 10% when Gd was used at 100% fertilisation level. When the nitrogen level was decreased to 75% an increase in yield with 14% was observed.
Spring Wheat in the UK

N-Fix
Control

Dotted line represents yield at recommended fertiliser N level.
Treatment with N-Fix showed an average 15% yield increase.

Maize in Germany and Belgium

N-Fix
Control

Dotted line represents yield at recommended fertiliser N level.
Average yield benefits across the various N levels resulted in an increase in yield of between 7% in Belgium and 21% in Germany (Koppert).

Maize in the US - Dana, Iowa 2017

N-Fix
Control

Dotted line represents yield at recommended fertiliser N level.
In three US sites the N-Fix treated plots trended towards a higher yield at every N level.

- Higher yield in both N-Fix treatments compared to the untreated control (p<0.001)
- For the on-seed treatment, yield was increased by 50.8% at 0 N, 3.5% at 25 N, 9.4% at 50 N, 6.6% at 75 N, and 14.7% at 100 N
- The yield bump with the in-furrow treatment was similar to that of the on-seed treatment except at 100% N where the in-furrow yield was similar to the untreated yield.

Soybean in the USA

N-Fix
Control

Dotted line represents yield at recommended fertiliser N level.
Highly significantly yield increase in N-Fix treatment compared to control at both N levels (p<0.001)

- The yield increase was 29% at 0 N and 8.4% at 44.8 kg N/ha when using N-Fix.

Modern agriculture needs to feed a growing population in a more sustainable way. Nitrogen is central to increasing plant yields to feed the world's growing population, however fertiliser technology has remained much the same for the last 50 years. This is the most important innovation in plant nutrition since Haber Bosch in 1913.