



# Carbon Dioxide. Tomato yields grow in Australia using CO<sub>2</sub> from Linde.

## The customer

Based in Mansfield, Victoria, Murphy Fresh is regarded as one of Australia's most successful hydroponic farms. Each year, the family business supplies more than 3.5 million kilos of premium, vine-ripened tomatoes to leading supermarkets including Coles, Woolworths and Aldi, as well as to independent greengrocers and restaurants around the country.

With a well-earned reputation for environmentally sustainable best practices, Murphy Fresh has continued to initiate ground-breaking growing methods since starting business on a 600 square-metre farm in 1998. Today, Murphy Fresh operates extensive glasshouse growing areas across approximately 4.5 hectares and employs around 50 staff, contributing significantly to the local economy.

Good food and produce have always been close to the heart of the Murphy family and they take great pride in producing what they regard as the best-tasting tomatoes in Australia.

The farm has been developed using the industry's cutting-edge technologies to facilitate the production of best-quality produce with the lowest environmental impact.

## The challenge

Carbon dioxide is essential for photosynthesis – the process by which plants grow and produce food. Photosynthesis entails plants using sunlight to absorb CO<sub>2</sub> and water and convert them into sugars, cellulose and starch.

CO<sub>2</sub> exists in the atmosphere at a concentration of approximately 340 ppm. In closed environments like greenhouses, this level can fall to about 120–180 ppm. This drop affects the photosynthesis process and subsequently reduces yields.

Like any business, Murphy Fresh was looking to maximise return on capital, minimise costs and increase revenue through higher yields. As a pioneer in alternative farming, Murphy Fresh wished to achieve these goals without compromising environmental protection.

## The solution

General Manager Jon Murphy was convinced that CO<sub>2</sub> enrichment was one of the major success factors that would enable Murphy Fresh to promote plant sugar production in tomatoes. Murphy Fresh turned to Linde Group member BOC to help it investigate CO<sub>2</sub> enrichment technology. As experts in the horticulture sector for over 25 years, Linde has developed an extensive range of solutions to help

## Benefits.

- Increased fruit yields in enclosed environments

increase yields while reducing operating costs. Under its Crop Science programme, the company builds on the Group's synergised expertise to offer proven supply systems and also engineer solutions tailored to meet specific farming challenges. Linde thus created a tailored CO<sub>2</sub> enrichment solution to enhance the greenhouse atmosphere in all of Murphy Fresh's greenhouses. After installation, the solutions was fine-tuned over a six-year period. "With the right people on both sides, we have been able to develop delivery systems to achieve the results we want," Jon said. "We are recommending CO<sub>2</sub> enrichment with Linde to many growers. They have offered outstanding service in ensuring the system can deliver the right amount of CO<sub>2</sub> to our greenhouses, ensuring we get the supply we need and that the price stays competitive," he added.

## Benefits

CO<sub>2</sub> enrichment has delivered significant advantages to Murphy Fresh since implementation.

“Being able to enrich our greenhouses with CO<sub>2</sub> gives us another level of environmental control, which enables us to increase the quality, taste and yield of our crops,” Jon said. He continued: “Not only does this improve the produce we deliver to our customers, it lowers our environmental footprint by enabling us to produce higher, better quality yields in a smaller space. CO<sub>2</sub> enrichment can result in yield gains of 20 percent and more”

One technical advantage of using pure CO<sub>2</sub> over other methods is the ability to directly inject the precise volume of CO<sub>2</sub> required into the greenhouse environment. Good greenhouse distribution, the absence of toxic fumes and the elimination of humidity issues inside the greenhouse are just some of the benefits. Seasonally, CO<sub>2</sub> can be easily controlled to adapt to winter and summer enrichment needs, allowing Murphy Fresh to align its enrichment strategy with the time of year.

“We plant in winter and grow through summer, so we have good enrichment opportunities from late winter to early summer and autumn. In summer, we cannot enrich in the middle of the day as it gets too hot. We do enrich in winter but as there is not a lot of light, we do not need to enrich as much. We generally start enriching as soon as we get our second truss flowering,” Jon explained. Over time, Murphy Fresh has also learned how to balance CO<sub>2</sub> enrichment more effectively with other greenhouses variables to achieve better results.



“For example if you just dose CO<sub>2</sub> and don’t change your growing strategies, you probably will only achieve 5 to 10% percent increases in yield. If you change other variables in your greenhouse – especially light and plant densities – you are able to achieve better results,” he explains. “We yielded 70kg/m<sup>2</sup> over four hectares of our operation in 2013, compared with 60kg/m<sup>2</sup> the previous season. We attribute this to a variety change with good use of CO<sub>2</sub> and management of plant densities.”

For optimal results, the farm maintains greenhouse CO<sub>2</sub> levels between 500 and 1000ppm during the plant emergence stage, growth stage and the fruit-bearing stage of the tomato. In most instances it enriches with CO<sub>2</sub> from sunrise until mid to late morning.

## Looking ahead

As Murphy Fresh continues to grow, it takes great pride in being able to offer rewarding opportunities to build long-term careers in hydroponic farming. With the support of Linde’s CO<sub>2</sub> enrichment technology, it will continue to build its business by lifting production and contributing to the local economy through the creation of jobs. The company is looking to expand its present operation by another 10 hectares in two five-hectare stages. “We are looking at setting this up with the continued support of Linde, using the same system we have in our current greenhouses,” Jon said.



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