Microclimates in New Zealand – Maximising agricultural output through use of microclimates. – Paul Stainthorpe

New Zealand’s largest Crown Research Institute, AgResearch Ltd, believes that new technologies will allow New Zealand farmers to double their output by 2020, while simultaneously reducing greenhouse-gas emissions and other detrimental environmental impacts associated with farming practices. [1] Microclimate utilization could be part of this technological surge in New Zealand’s agriculture. Microclimates are local atmospheric zones where the climate differs from the climate of the surrounding area. The main factors in a microclimate are temperature, humidity, light and wind exposure, soil type and topography. Each microclimate is different, and if used correctly can provide ideal or optimum conditions for plant growth and survival, potentially maximising the yield of the crop.

A History of New Zealand and Microclimates

New Zealand is a country built on agriculture, and has a strong history and future in the industry. As well as agriculture’s economic effects, agriculture also has had a social and cultural impact on New Zealand, resulting in the do-it-yourself and ingenious mentality of us Kiwis, the famous “number 8 wire”. New Zealand has a history of successful uses of microclimates, with the Topoclimate Farm Planning the only programme identifying and mapping microclimates at a farm scale anywhere in the world. The award winning Chard Farm Winery was established on the north facing slopes of Kawarau Gorge in Central Otago after the site was identified using Topoclimate mapping of microclimates. [2] Just down the road from Queenstown where it is too cold to grow grapes, in the Kawarau Gorge, farmers have discovered that the unique microclimates on the lower sloping fans and terraces above the engeroved river, enables them to grow world-beating Pinot Noir Wines in this area. The successful growth of wines and grapes is unusual as in the surrounding macroclimate of Central Otago grapes are unable to be grown. The north facing slopes created a warmer microclimate, where the extra sun and as a result warmer soil and air temperatures enabled these award winning wines to be grown. [2] The Central Otago macroclimate from 1998 to 2002 had on average 204 Growing Degree Days (GDD)s of Heat above 10ºC on average for a whole year. This is considerably less than the average 294 GDD’s above 10 ºC that Hawkes Bay and the 280 GDD’s the Bay of Plenty experienced over the same time period. The differences in GDD suggests that it should be impossible to grow wine in Central Otago as there is not enough heat especially during the winter months. (graphs and tables will be provided in presentation) [3] However despite the major discrepancy in the overall macroclimates of the area, after the Topoclimate microclimate survey was completed it was discovered that there were plenty of warmer, north facing, sheltered spots on many of their farms, where there was more than the minimum amount of accumulated heat and sun. The wine and maize crops in these microclimates have been highly successful. Another way people have created microclimates is the common practise in kiwifruit and other orchards through hedging. Hedging crops works to shelter plants from the wind, affecting air temperatures as well as wind, changing the microclimate of the hedged plot of land.

Implications of Microclimatology

Through the manipulation and/or creation of these microclimates to gain ideal conditions for growing crops, we can maximise our crop yields and increase our exports and the value of the agriculture sector. Microclimates can allow us to grow crops where the traditional crops have failed, utilising more of the land set aside for farming and stopping soil erosion. As a country where the main industry

and export is agriculture and horticulture, the better utilization of the land set aside for farming would have a positive economic and a strong potential social and environmental effect as well. It could well create extra jobs in the industry replacing those lost in the 2008 recession, whilst maximising profits. The Ministry for Agriculture and Forestry’s Situation and Outlook for New Zealand Agriculture and Forestry (2011) stated that while “Agriculture sector income, an aggregate measure equivalent to the overall agricultural sector’s farm-gate profitability, is estimated to have risen by 13 percent in the year to 31 March 2011.” New Zealand’s “main horticultural crops have not experienced the same rises in price as the other sectors. Wine export prices have declined and profit margins for wineries and growers are tight. Production of kiwifruit and wine is forecast to rise gradually over the coming years; in the case of wine this increase is significantly less than seen over the past decade as very little new planting is expected.” [4] Microclimate assessment and utilization could revitalize the horticulture sector, creating growth in employment and profits. As part of this, AUT has recognised the need and market for technology in this area, and so have created a microclimate monitoring system to gather and analyze climate, atmosphere, and plant and soil data. “AUT’s technology enables growers to assess micro-climate variability within their plot; as a result they can use resources when and where they are most needed. Potential benefits derived from the technology include: increased yield and quality, accurate frost prediction and optimised use of resources (i.e. water, pesticides).” [6]

There is a lack of research on how changes in the different factors affect a microclimate. The Ministry of Environment predicts that climate change will increase temperatures up by about 1°C by 2040. Climate change could affect seasonal patterns with projected increases of Westerly’s in winter and spring, along with more rainfall in the west of both the North and the South Island and drier conditions in the east and north. [5] With the significant effect this would have on our main export industries of agriculture and horticulture it is important that New Zealand does further research in this area to enable us to continue to get the best out of our environment through the manipulation and creation of microclimates. This will help to protect our future in horticulture and agriculture.

Taking Microclimates From Industry to Wider Society

From the glass house to the wider farming community microclimates have not only an important part to play in the ongoing success of the New Zealand Economy, but also have a part to play in New Zealand Society. However Microclimates are not just out in the countryside and on the farm, they are in our cities in the back-garden, or on the balcony or windowsill. When we grow plants and fruit trees, not only do we become more self-sustaining and are able to obtain food more cheaply, this has a positive environmental effect through reducing the carbon footprint and reducing greenhouse gases. An example of how better education on growing food for ourselves and the positive social economic and environmental effects it has are the Kitchen Garden Foundation of Australia, and the Garden to Table Trust of New Zealand which focus on teaching kids to grow their own food in a suburban and urban setting. The Australian Government has recently committed further funding of 5.4million dollars on top of the previous 12.8million dollars to enable another 400 schools to teach students in partnership with the Kitchen Garden Foundation about where and how to grow plants, and the benefits. [7]

Through knowledge on how to grow plants and understanding how microclimates work through knowing where to grow plants, there are positive economic, environmental and social effects. By teaching this knowledge at the grassroots level, businesses take notice and innovations will occur, like what happened with the Central Otago wine fields. The government support for organizations promoting education in addition to funding at the corporate and scientific level will help revitalize and grow New Zealand’s horticulture and economy.