



**FARMERS CAN
CHAMPION OUR
ECONOMIC RECOVERY
AND ZERO CARBON
ECONOMY
HERE'S HOW**

www.zestbiotech.co.nz

BIOZEST & FAO OPTIONS

The United Nations Food and Agricultural Organisation has published a range of options farmers could take to increase agricultural production and consequently reduce greenhouse gas emissions and their environmental footprint. These options are based on international scientific research projects and consensus among international scientists, Biozest can be used as a tool to implement many of the recommended options to reduce agricultural emissions and environmental footprint. The result is increased production and less waste of resources as urea, methane and nitrous oxide. More profit, less gas and urea.

Biozest has been proven in trials to:

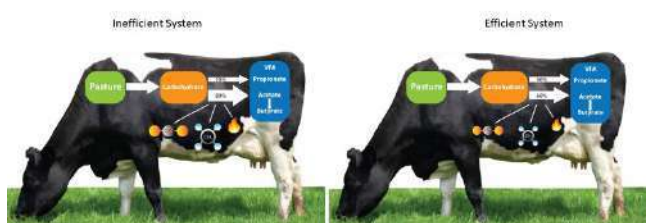

- Increase pasture productivity (Kg dry matter/hectare) (by 89-127%),
- Increase pasture palatability (kg dry matter consumed) (by more than 10%),
- Improve pasture performance in stress conditions (frost, drought and waterlogging),
- Lift soluble sugar production to improve ruminant digestion (by 18%),
- Improve stock condition (stud bulls returned an additional \$1645 per bull at sale),
- Increase dairy cow productivity: increased milk volume and milk solids,
- Increase dairy goat productivity: an additional 31% of milk volume and 33% of milk solids over a full milking season,
- Reduce the environmental impact of dairy farming. Both dairy cows (24-36% reduction) and dairy goats (36% reduction) excreted lower levels of urea in urine to help cut nitrate leaching and greenhouse gas emissions. In addition, the urea excreted is expected to be in a less leachable form.

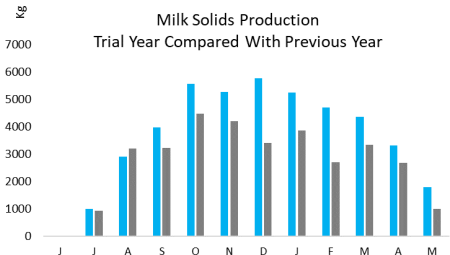
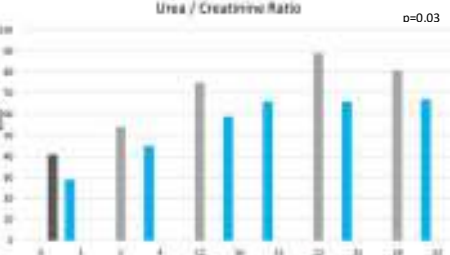
The table below illustrates how Biozest can be used as a tool to implement many of the recommended options that will reduce greenhouse gas and nitrate emissions from agriculture. The links to the references the support the options and claims are included.


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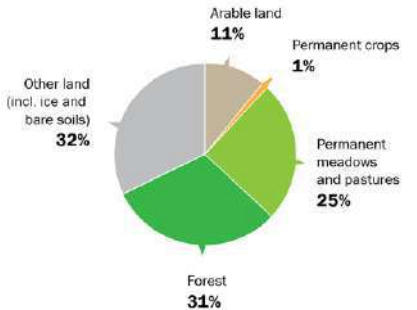
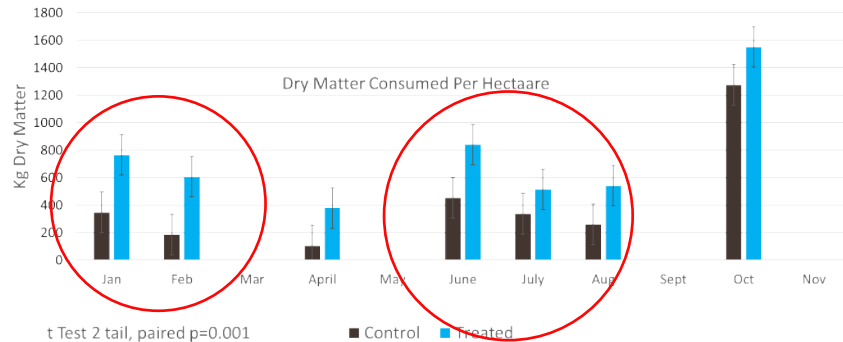
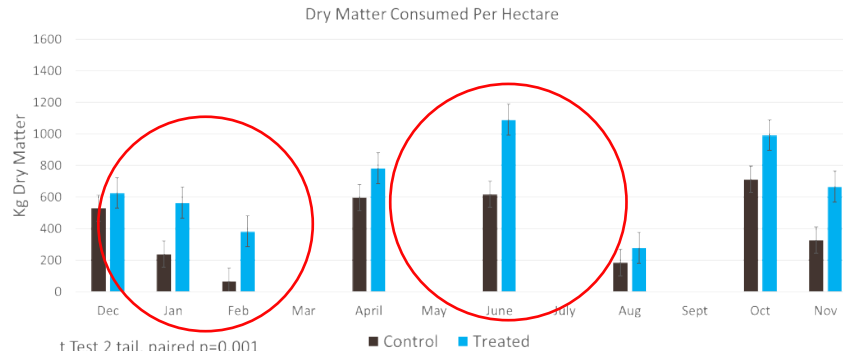
<p>FAO Options for Reducing GHG Emissions http://www.fao.org/3/C/A2929EN/ca2929en.pdf</p>	<p>Biozest Results. https://www.zestbiotech.co.nz/biozest-trials</p>	<p>All claims are backed by independent trial data, farm production, evidence and science</p>
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1. Ruminant Efficiency



<p>GHG emissions represent inefficiencies in livestock systems. The loss of methane and nitrous oxide into the atmosphere means that energy and nitrogen inputs which could be directed towards production is lost. (pg. 31)</p>	<p><u>We have improved the efficiency of the carbohydrate and protein digestive systems to convert more pasture to milk and meat. Therefore, less inputs are wasted as ammonia, urea (nitrous oxide) and methane.</u></p> <p>When livestock graze Biozest treated pasture, milk and meat production may be increased by 30%. Urea excretion may be reduced by up to 48%.</p> <p>This shows that efficiency is increased resulting in less waste (urea and GHG emissions) and more milk/meat.</p>	<p style="text-align: center;">Carbohydrate Digestive System</p>  <p style="text-align: center;">Protein Digestive System</p> 
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<p>Increase feed efficiency by optimizing the energy and protein content in feed.</p>	<p><u>Biozest increases the functional quality of pasture.</u> Biozest treatment enables the pasture itself to synthesise more simple sugars and bioactive molecules (phenylpropanoids) that can <u>improve carbohydrate and protein digestion efficiencies.</u></p>	<p style="text-align: center;">Dairy Goats Full Life Cycle Trial Results</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="996 893 1478 1228"> <p style="text-align: center;"><u>Milk Solids Production</u></p>  <p style="text-align: center;">Source: Dairy Goat Cooperative</p> </div> <div data-bbox="1500 893 1971 1228"> <p style="text-align: center;"><u>Urea Excretion</u></p>  </div> </div> <p style="text-align: center;"><u>Less waste more production</u></p>
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2.Feed and Feed Management																																																														
<p>Use more locally produced feed.</p> <p>Feed is the largest single cost to producers and its efficient use will improve net income and reduce potentially negative impacts on the environment (pg.31).</p> <p>“New Zealand pastures often contain a higher concentration of nitrogen (N) than required by ruminants, and this can be exacerbated by application of N fertilisers to boost pasture growth. Excess N intake relative to requirements can also become a significant additional cost to farming. Excess N can also have negative impacts on animal and environmental welfare.” Pacheco & Waghorn, 2008 (https://www.nzgajournal.org.nz/index.php/ProNZGA/article/view/2738)</p>	<p><u>Pasture productivity may be doubled</u> resulting in more feed produced on farm and <u>less need</u> for imported supplementary feed.</p> <p>Biozest improves pasture production without the use of additional fertilisers. Baleage production has been doubled in trials. Analysis of the baleage from control and treated areas found that pasture production was doubled with no negative impact on feed quality and dry matter production.</p> <p>Biozest treated pasture is more palatable, livestock graze the pasture right down and evenly, leaving minimum residuals to rot and emit CO₂ and methane.</p>	<p style="text-align: center;">Increase Baleage Production</p> <table border="1" data-bbox="1220 188 1904 300"> <thead> <tr> <th>1st Cut 21/10/2017</th> <th>Bales</th> <th>Bales/ha</th> <th>% increase in yield per hectare</th> </tr> </thead> <tbody> <tr> <td>Treated</td> <td>110</td> <td>11.3</td> <td>117%</td> </tr> <tr> <td>Untreated</td> <td>43</td> <td>5.2</td> <td>p=0.005</td> </tr> </tbody> </table> <p style="text-align: center;"><small>(p=0.005 (99.5% confidence level) 2 tailed homoscedatic)</small></p> <table border="1" data-bbox="1220 347 1904 475"> <thead> <tr> <th>Post Grazed Paddocks</th> <th>Bales</th> <th>Bales/ha</th> <th>% increase in yield per hectare</th> </tr> </thead> <tbody> <tr> <td>Treated</td> <td>71</td> <td>20.4</td> <td>115%</td> </tr> <tr> <td>Untreated</td> <td>39</td> <td>9.5</td> <td>P=0.02</td> </tr> </tbody> </table> <p style="text-align: center;"><small>(p=0.02 (98% confidence level) 2 tailed homoscedatic)</small></p> <table border="1" data-bbox="1220 531 1904 675"> <thead> <tr> <th>Certified Organic Farm</th> <th>Bales</th> <th>Bales/Ha (Average)</th> <th>% increase in yield per hectare</th> </tr> </thead> <tbody> <tr> <td>Treated</td> <td></td> <td>13.31</td> <td>78%</td> </tr> <tr> <td>Untreated</td> <td></td> <td>7.47</td> <td>p=0.04</td> </tr> </tbody> </table> <p style="text-align: center;">Less residual pasture in Biozest treated paddocks.</p> <table border="1" data-bbox="1176 746 1948 898"> <thead> <tr> <th>Date</th> <th>04/08/2010</th> <th>15/10/2010</th> <th>19/10/2010</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>Paddock No.1</td> <td>After grazing</td> <td>Before grazing</td> <td>After grazing</td> <td>Increase in growth (between grazing)</td> <td>DM consumed</td> </tr> <tr> <td>Control</td> <td>1164</td> <td>1816</td> <td>776</td> <td>652</td> <td>1040</td> </tr> <tr> <td>Treated</td> <td>995</td> <td>1797</td> <td>540</td> <td>802</td> <td>1257</td> </tr> </tbody> </table> <p style="text-align: center;">Livestock preferentially graze Biozest treated pasture.</p> 	1st Cut 21/10/2017	Bales	Bales/ha	% increase in yield per hectare	Treated	110	11.3	117%	Untreated	43	5.2	p=0.005	Post Grazed Paddocks	Bales	Bales/ha	% increase in yield per hectare	Treated	71	20.4	115%	Untreated	39	9.5	P=0.02	Certified Organic Farm	Bales	Bales/Ha (Average)	% increase in yield per hectare	Treated		13.31	78%	Untreated		7.47	p=0.04	Date	04/08/2010	15/10/2010	19/10/2010			Paddock No.1	After grazing	Before grazing	After grazing	Increase in growth (between grazing)	DM consumed	Control	1164	1816	776	652	1040	Treated	995	1797	540	802	1257
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FAO Options	Biozest Results	Biozest Data
3. Carbon Sequestration, Pasture Productivity and Density.		
<p>Permanent pastures are a means of storing carbon.</p> <p>FAO recommendation: Store more carbon in the soil by means of better grassland management.</p> <p>Permanent grasslands (3.3 billion hectares) are estimated to contain globally 343 billion tonnes of carbon, 50% more than is stored in forests (~4.1 billion hectares) worldwide (http://www.fao.org/3/a-i8098e.pdf, pg. 5). Therefore, our pastures are capable of storing more carbon per hectare than a hectare of forest.</p> <p>Global land cover</p>  <p>Source: FROSTAT</p>	<p><u>Biozest treatment can double pasture productivity</u> and therefore, sequester twice as much carbon as untreated pasture.</p> <p>This also means that Biozest treated pasture can sequester 3 times as much carbon as the same area of forest.</p> <p><u>Biozest improves pasture cover, density and resilience.</u> Trials confirm Biozest treatment resulted in denser pasture cover and double the pasture baleage yield; the pasture is more climate resilient.</p>	<p style="text-align: center;"><u>Double productivity and climate resilience</u></p> <p style="text-align: center;">Drought and Frost Tolerance</p>  <p style="text-align: center;">Performance Under Soil/Water Stress</p> 

FAO Options	Biozest Results	Biozest Data
<p>FAO recommendation: Store more carbon in the soil by means of better grassland management.</p>	<p>Pasture may look lush and productive but if the blades of grass and other pasture plants are pushed aside, significant areas of bare earth can be seen in between the crowns of pasture species.</p> <p>Biozest treatment produces thicker, denser pasture to cover the bare land. This increases productivity per hectare without the need for additional water, land or fertilisers. Biozest maximises the utilisation of resources.</p> <p>“On-farm benefits of resilient pastures that have increased ground cover include increased soil and soil C retention and reduced losses of nutrients, soil-bound metals and faecal microorganisms.” De Klein, Cecile & Monaghan, Ross & Donovan, Mitchell & Wall, Aaron & Schipper, Louis & Pinxterhuis, Ina. (2021). Attributes of resilient pasture for achieving environmental outcomes at farm scale. NZGA: Research and Practice Series. 17. 10.33584/rps.17.2021.3487.</p>	<p style="text-align: center;"><u>Under Utilised Potential</u></p> <div style="display: flex; justify-content: space-around;">   </div> <p style="text-align: center;">Untreated pasture appears lush and full but lacks density at ground level.</p> <p style="text-align: center;"><u>Pasture is more dense in Biozest Treated Paddocks.</u></p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>CONTROL</p>  </div> <div style="text-align: center;"> <p>BIOZEST</p>  </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;">   </div> <p style="text-align: center;">Biozest maximises production by increasing the spread of pasture crowns and clovers and so pasture density is increased and fully utilises land already fertilised and irrigated.</p>

FAO Options	Biozest Results	Biozest Data																					
4. Animal health and husbandry																							
<p>Reducing the prevalence of diseases and parasites would generally reduce emissions intensity as healthier animals are more productive, and thus produce lower emissions per unit of output.</p>	<p>Both trial data and observations show body condition, health and livestock productivity increases.</p>	<div style="display: flex; justify-content: space-around;">   </div> <p>Livestock grazing Biozest treated pasture develop better coat and body condition and are less prone to scours. Livestock are cleaner and have shiny, healthy coats.</p> <table border="1" data-bbox="1274 576 1890 839" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3" style="text-align: center;">Lamb and Ewe Weight at Docking</th> </tr> <tr> <th></th> <th style="text-align: center;">Ewes</th> <th style="text-align: center;">Lambs</th> </tr> </thead> <tbody> <tr> <td>Biozest</td> <td style="text-align: center;">73.29</td> <td style="text-align: center;">23.49</td> </tr> <tr> <td>Control</td> <td style="text-align: center;">69.01</td> <td style="text-align: center;">22.73</td> </tr> <tr> <td>Difference</td> <td style="text-align: center;">4.27</td> <td style="text-align: center;">0.75</td> </tr> <tr> <td>% Difference</td> <td style="text-align: center;">6%</td> <td style="text-align: center;">3%</td> </tr> <tr> <td>t test p=</td> <td colspan="2" style="text-align: center;">0.006</td> </tr> </tbody> </table> <p>Normally Ewes lose condition after lambing. Ewes grazing on Biozest treated pasture improved body weight condition as did the lambs: at docking their weight was 0.8 Kg heavier.</p>	Lamb and Ewe Weight at Docking				Ewes	Lambs	Biozest	73.29	23.49	Control	69.01	22.73	Difference	4.27	0.75	% Difference	6%	3%	t test p=	0.006	
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5. Other Emissions Sources																							
<p>Reduce fodder and feed production including application of mineral fertilizer (pg. 15)</p>	<p>Biozest treatment increases pasture productivity eliminating the need to import supplementary feed. The importation of carbon liabilities is avoided. An additional loss of carbon due to cultivation is avoided. This supports our grass-fed brand.</p>	<table border="1" data-bbox="1090 1026 2074 1235" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="4" style="text-align: center;">19 Day Split Paddock Trial: Kg Dry Matter/ha</th> </tr> <tr> <th style="text-align: center;">Paddock No.</th> <th style="text-align: center;">Control Half</th> <th style="text-align: center;">Treated Half</th> <th style="text-align: center;">Increase</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">40</td> <td style="text-align: center;">275</td> <td style="text-align: center;">521</td> <td style="text-align: center;">89%</td> </tr> <tr> <td style="text-align: center;">42</td> <td style="text-align: center;">277</td> <td style="text-align: center;">630</td> <td style="text-align: center;">127%</td> </tr> </tbody> </table>	19 Day Split Paddock Trial: Kg Dry Matter/ha				Paddock No.	Control Half	Treated Half	Increase	40	275	521	89%	42	277	630	127%					
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6.Organic Production Systems http://www.fao.org/3/CA2607EN/ca2607en.pdf , http://www.fao.org/organicag/oa-specialfeatures/oa-climatechange/en/		
<p>“FAO promotes organic agriculture as an alternative approach that maximizes the performance of renewable resources and optimizes nutrient and energy flows in agroecosystems.</p> <p>Life cycle assessments show that emissions in conventional production systems are always higher than those of organic systems, based on production area.</p> <p>Many field trials worldwide show that organic fertilization compared to mineral fertilization is increasing soil organic carbon and thus, sequestering large amounts of CO₂ from the atmosphere to the soil.”</p>	<p>Biozest significantly increases productivity on certified organic farms.</p> <p>The increase in productivity on organic farms using Biozest confirms that a high level of productivity is achievable where nutrient energy flow is optimised.</p> <p>Biozest reduces environmental stress in pasture (such as frost, drought, waterlogging) resulting in a climate resilient, productive system.</p> <p>Biozest treatment results in denser pasture growth, thus maximising resource utilisation. Refer to graphs in section “Carbon Sequestration” page 5, above).</p>	<p>A certified organic farm is using Biozest for the 1st time this season. The 1 March 2021 supply comparison shows MS production is 42% higher than last season and 21% higher than the 2018/2019 season.</p>  <p>Another organic farm produced milk solids output 49% higher than last season as of 6th March 2021.</p> 

Conclusion

1. Increasing pasture production will sequester more carbon.
2. Increasing milk and meat production will reduce methane and nitrous oxide emissions

We have optimised utilisation of resources and maximised nutrient and energy conversion to milk and meat.

This increase in efficiency results in increased production and less waste of resources (urea, methane and nitrous oxide). More Profit, Less Gas and Urea.