

| Project Code: | Project Name:                              | Use of GMO               | Question 1                                   |               | Question 2 |            | Question 3          | Question 4  | Question 5  |
|---------------|--|--------------------------|--|---------------|------------|------------|---------------------|---|---|
|               |  |                          | Funders/Stakeholders                         | Breakdown     | Start Date | End Date   | Initator of Project | Estimated Return on income  | Expected Benefits   |
| 15795         | AI on hooves                               | Future - Limited Release | Ministry of Business Innovation & Employment | \$ 1,150,000  | 01/10/2017 | 31/05/2021 | AgResearch          | The original estimate for the project was for approximately \$10m pa national benefit with adoption of the outcomes of the project (short tail easy care trait) in the national sheep herd. | Pathways to market, where release of rams with the trait developed from the project permitted, would be expected through providing access to those rams to stud breeders. End users would be expected to be farmers who would access the rams for genetic improvement of their flocks.  |
|               |  |                          | Total Revenue:                               | \$ 1,150,000  |            |            |                     |   |   |
| 50215         | GM Forages                                 | Future - Full Release    | DairyNZ Inc                                  | \$ 3,650,000  | 01/07/2017 | 31/07/2024 | AgResearch          | Modelling suggests a potential increase in farm revenues of up to \$900 per ha, where the HME ryegrass is adopted.  | The HME ryegrass would be expected through licensing of the ryegrass cultivar by Grasslanz Technology to NZ seed companies, if regulatory approval is obtained for NZ release, and possibly to overseas seed companies. The ryegrass has an increased lipid content which should result in improved animal nutrition. This is also anticipated to provide potential reductions in both methane and nitrous oxide emissions from animals grazed on the ryegrass, which we will understand better after the completion of animal trials.  |
|               |  |                          | Grasslanz Technology Limited                 | \$ 200,000    |            |            |                     |   |   |
|               |  |                          | Ministry of Business Innovation & Employment | \$ 8,500,201  |            |            |                     |   |   |
|               |  |                          | PGG Wrightson Seeds Ltd                      | \$ 300,000    |            |            |                     |   |   |
|               |  |                          | Total Revenue:                               | \$ 12,650,000 |            |            |                     |   |   |
| 50217         | Science Prize Plant Biotech                | Research Tool            | SSIF   | \$ 260,000    | 01/09/2017 | 30/09/2019 | AgResearch          | No analysis has been completed for this project   | HME technology raises metabolisable energy via accumulation of lipid in the leaf. It also simultaneously elevates photosynthesis. This work established the tools used in elucidating the cellular mechanism(s) underlying elevated photosynthesis.   |
|               |  |                          | Total Revenue:                               | \$ 260,000    |            |            |                     |   |   |
| 11354X05      | Gastrointestinal interactions primary cell | Research Tool            | Massey University                            | \$ 340,000    | 01/07/2018 | 30/06/2021 | AgResearch          | No analysis has been completed for this project   | The development of intestinal cell models from multiple animal species will enable developments in fundamental research (eg, animal specific, or comparative differences) and commercial research (eg, probiotic development, food-microbe-host interactions) leading to increased opportunities for future research, both nationally and internationally. This work supports the accumulation of scientific knowledge about intestinal biology of different animal species and acquisition of skills associated with this type of experimentation, enabling AgResearch to remain competitive with overseas laboratories. Even if benefits arising from the application of this knowledge (such as medical or dietary), are initially identified in overseas research organisations, this may still lead to public good outcomes for New Zealand. |
|               |  |                          | Total Revenue:                               | \$ 340,000    |            |            |                     |   |   |

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| 12991X02   | Inhibitors FY19                                   | Future - Production system in containment | PGGRC-Pastoral Greenhouse Gases Research Consortia | \$ 2,570,000                                       | 01/07/2018   | 30/06/2020 | AgResearch | No analysis has been completed for this project   | Methane inhibitors, if successfully developed and adopted, are aimed to reduce methane emissions by at least 20% from ruminant animals with no adverse effects on animal productivity. Allows reduced exposure to costs imposed on NZ farmers as part of future greenhouse gas accounting systems. May be critical for continued market access, esp. to global food manufacturers and distributors. |
|            |   |   |  | Total Revenue:                                     |              |            |            |   |   |
| 12991X07   | FY19 5.3 Vaccine microbiology                     | Future - Production system in containment | New Zealand Agricultural Greenhouse Gas Research   | \$ 345,000   | 01/07/2018   | 30/06/2021 | Partner    | No analysis has been completed for this project   | At least 20% reduction of methane emissions from farmed ruminants receiving the developed vaccine. Allows reduced exposure to costs imposed on NZ farmers as part of future greenhouse gas accounting systems. May be critical for continued market access, esp. to global food manufacturers and distributors.   |
|            |   |   |  | PGGRC-Pastoral Greenhouse Gases Research Consortia | \$ 755,000   |            |            |   |   |
|            |   |   |  | Total Revenue:                                     | \$ 1,100,000 |            |            |   |   |
| 14520x03   | Fermented Foods Obj 3 Tastant Detection           | Research Tool                             | Ministry of Business Innovation & Employment       | \$ 1,830,000                                       | 01/10/2017   | 31/12/2022 | AgResearch | At commencement of the project, estimated net export revenue gain, if the outcomes from the project are taken to market, was up to NZ\$189m per annum by 10 years post completion of the programme. | The ultimate goal of the research programme this forms part of is to provide next generation fermented food products for export markets, through uptake of new knowledge and technology outputs from the programme.   |
|            |   |   |  | Total Revenue:                                     | \$ 1,830,000 |            |            |   |   |
| 294056x03  | NGB Production and Formulation                    | Research Tool                             | Ministry of Business Innovation & Employment       | \$ 520,000   | 01/07/2016   | 31/12/2019 | AgResearch | No analysis has been completed for this project   | This project is part of a wider programme of work to develop new generation microbial biopesticides to that might replace synthetic products. The ultimate goal is to create biopesticides for mainstream agriculture that will result in more high quality, chemical residue-free whole foods and ingredient exports.  |
|            |   |   |  | Total Revenue:                                     | \$ 520,000   |            |            |   |   |
| 50210x01   | GM Forages High ME - Core                         | Future - Full Release                     | SSIF   | \$ 3,800,000                                       | 01/07/2017   | 21/01/2023 | AgResearch | See above project code 50215  | See above project code 50215  |
|            |   |   |  | Total Revenue:                                     | \$ 3,800,000 |            |            |   |   |
| PRJ0044654 | Insect active nano-machines                       | Research Tool                             | Ministry of Business Innovation & Employment       | \$ 1,000,000                                       | 01/10/2018   | 30/06/2022 | AgResearch | No analysis has been completed for this project   | This fundamental research project may support future alternatives to chemical insecticides. The knowledge outcomes are being used to support an ACVM regulatory package.  |
|            |   |   |  | Total Revenue:                                     | \$ 1,000,000 |            |            |   |   |
| PRJ0110170 | Application of Plant Biotechnology in Agriculture | Future - Full Release                     | DairyNZ Inc  | \$ 200,000   | 01/07/2019   | 30/06/2022 | AgResearch | See above project code 50215.   | See above project code 50215.   |
|            |   |   |  | PGG Wrightson Seeds Ltd                            | \$ 100,000   |            |            |   |   |
|            |   |   |  | SSIF   | \$ 7,110,000 |            |            |   |   |
|            |   |   |  | Total Revenue:                                     | \$ 7,410,000 |            |            |   |   |
| PRJ0110180 | Epichloë Endophytes for the Future Farm           | Future - Full Release                     | SSIF   | \$ 7,420,000                                       | 01/07/2019   | 30/06/2023 | AgResearch | After adoption, a new endophyte strain may yield approximately \$300m per annum value to the New Zealand economy  | Epichloë endophyte technology is a critical component of New Zealand pasture based production systems due to and abiotic advantages conferred to the host grass. Research will develop next generation Epichloë-forage grasses to mitigate emerging pressures such as greenhouse gas emissions, climate change, increased insect pressures and resource limitations.                                |
|            |   |   |  | Total Revenue:                                     | \$ 7,420,000 |            |            |   |   |

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| PRJ0119461 | Improving resource efficiency using gene edited endophytes | Future - Full Release    | Grasslanz Technology Limited                 | \$ 6,110,000  | 01/07/2019 | 30/06/2026 | Grasslanz Technology | Direct value-add from new endophyte sales, if adopted, have an estimated marginal benefit to sellers of \$118m after 20 years post-completion of the programme  | Endophyte strains expressing new pesticidal compounds without affecting mammals can be introduced to further lift resource use efficiency, reduce environmental impacts, and provide health benefits to grazing livestock. In the future, development of this platform will enable new beneficial traits to be conferred to forage grasses using endophytes as the delivery system.   |
|            |  |                          | Ministry of Business Innovation & Employment | \$ 4,090,000  |            |            |                      |   |   |
|            |  |                          | <b>Total Revenue:</b>                        | \$ 10,200,000 |            |            |                      |   |   |
| PRJ0126332 | Food Integrity Food Omics                                  | Research Tool            | Kiwi Innovation Network Limited              | \$ 10,000     | 01/07/2019 | 28/06/2024 | AgResearch           | No analysis has been completed for this project   | The project aims to develop an assay to detect food borne pathogens using advanced technologies, such as in dairy and poultry. The technology may assist industry to respond to reduce contamination in the food chain.   |
|            |  |                          | SSIIF  | \$ 1,710,000  |            |            |                      |   |   |
|            |  |                          | <b>Total Revenue:</b>                        | \$ 1,720,000  |            |            |                      |   |   |
| PRJ0133302 | High-value New Zealand pigs for transplantable biomaterial | Future - Limited Release | Ministry of Business Innovation & Employment | \$ 1,000,000  | 01/10/2019 | 30/09/2023 | AgResearch           | At commencement of the project, NPV of estimated benefit to NZ at 10 years post adoption of the research outcomes was \$86M   | The ultimate goal of the research is to support the development of gene-edited pigs for harvesting of immune-compatible biomaterials for humans, principally kidneys. The technology would be applied domestically through Nzeno.   |
|            |  |                          | NZeno Limited                                | \$ 35,000     |            |            |                      |   |   |
|            |  |                          | <b>Total Revenue:</b>                        | \$ 1,035,000  |            |            |                      |   |   |
| PRJ0133413 | Rapidly evolving climate-smart dairy cattle                | Future - Full Release    | CRV Ambreed NZ Ltd                           | \$ 250,000    | 01/10/2019 | 30/06/2025 | AgResearch           | Directly introgressing two natural heat tolerance variants will return an estimated total (real) net present value (NPV) by 2034 of \$200M, if the technology is adopted. Independent of regulatory approval, improved capture of unedited elite embryo genotypes has an NPV of \$240M. | Proven impact of sequence variants will increase accuracy of genomic selection in New Zealand. Improved production efficiencies of the New Zealand dairy herd with improved genetics.   |
|            |  |                          | Livestock Improvement Corporation Ltd        | \$ 250,000    |            |            |                      |   |   |
|            |  |                          | Ministry of Business Innovation & Employment | \$ 10,000,000 |            |            |                      |   |   |
|            |  |                          | <b>Total Revenue:</b>                        | \$ 10,500,000 |            |            |                      |   |   |
| PRJ0140317 | CRB-G Biocontrol   | Research Tool            | Ministry of Foreign Affairs & Trade (MFAT)   | \$ 11,450,000 | 01/11/2019 | 30/06/2025 | Partner              | No analysis has been completed for this project   | This programme is for AgResearch to implement a component of the Pacific Response to Coconut Rhinoceros Beetle under the New Zealand Aid Programme and is principally for the benefit of partner countries in the Pacific. The goals of the programme are to limit the spread of CRB, reduce existing populations to lessen impact on coconut and oil palm industries, develop long term solutions to CRB management through biocontrol and integrated pest management, and enhance regional capacity in pest detection and response management.  |
|            |  |                          | <b>Total Revenue:</b>                        | \$ 11,450,000 |            |            |                      |   |   |
| PRJ0187198 | Condensed tannins in white clover                          | Future - Full Release    | Grasslanz Technology Limited                 | \$ 700,000    | 01/01/2020 | 30/06/2023 | AgResearch           | Analysis has suggested that the return to the IP owner, if the white clover is commercialised and released in NZ, would be in the region of \$1.44 per kg of seed sold in NZ, with slightly differing royalty rates applicable if the clover is released in other countries.            | If successful and the outcomes adopted in the New Zealand market, this project has the potential to significantly increase economic net revenue to New Zealand farmers as well as improve environmental challenges facing the farming industry by: <ul style="list-style-type: none"> <li>•reducing the \$100M/year loss due to bloat</li> <li>•increase milk yield and wool growth by up to 10%</li> <li>•increasing ovulation rate and reduce parasitic load</li> <li>•enhancing N use efficiency by up to 60%</li> <li>•mitigating energy loss by as much as 5%</li> <li>•increasing live weight gain by up to 30%</li> <li>•reducing the emission of GHGs by 5-10%</li> </ul> |

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|------------|--|---|--|--------------|------------|------------|------------|--|--|
|            |  |   | Total Revenue:                                     | \$ 700,000   |            |            |            |  |  |
| PRJ0385684 | Condensed Tannins in White Clover: FY22            | Future - Full Release                     | Grasslands Innovation Limited                      | \$ 400,000   | 01/07/2021 | 30/06/2023 | AgResearch | See PRJ0187198 above   | See PRJ0187198 above   |
|            |  |   | Grasslanz Technology Limited                       | \$ 455,000   |            |            |            |  |  |
|            |  |   | SSIF   | \$ 6,000     |            |            |            |  |  |
|            |  |   | Total Revenue:                                     | \$ 861,000   |            |            |            |  |  |
| PRJ0187359 | Inhibitors FY20                                    | Future - Production system in containment | PGGRC-Pastoral Greenhouse Gases Research Consortia | \$ 1,319,000 | 01/09/2019 | 30/06/2021 | Partner    | No analysis has been completed for this project  | See 12991X02 above   |
|            |  |   | Total Revenue:                                     |              |            |            |            |  |  |
| PRJ0209904 | FY20 5.3 Methane Vaccine                           | Future - Production system in containment | PGGRC-Pastoral Greenhouse Gases Research Consortia | \$ 730,000   | 01/07/2019 | 31/12/2020 | Partner    | No analysis has been completed for this project  | See 12991X07 above   |
|            |  |   | Total Revenue:                                     |              |            |            |            |  |  |
| PRJ0239347 | Generating non-heading ryegrass                    | Future - Full Release                     | University Of Otago                                | \$ 200,000   | 01/07/2020 | 30/09/2022 | Partner    | Non-heading ryegrass cultivars are predicted to provide an average profit increase for dairy farmers of \$650 to \$1,000 per hectare per annum | In late spring, ryegrass undergoes heading (flowering), which causes a significant drop in metabolizable energy from pasture. The goal of the programme is to develop non-heading ryegrass, that will maintain high levels of metabolizable energy through summer and autumn, principally for the benefit of the New Zealand farmer.   |
|            |  |   | Total Revenue:                                     | \$ 200,000   |            |            |            |  |  |
| PRJ0263184 | Methane Vaccine 5.3 FY21                           | Future - Production system in containment | New Zealand Agricultural Greenhouse Gas Research   | \$ 750,000   | 01/07/2020 | 31/12/2021 | Partner    | No analysis has been completed for this project  | See 12991X07 above   |
|            |  |   | PGGRC-Pastoral Greenhouse Gases Research Consortia | \$ 2,650,000 |            |            |            |  |  |
|            |  |   | Total Revenue:                                     | \$ 3,400,000 |            |            |            |  |  |
| PRJ0277399 | Methane Inhibitors 5.4 FY21                        | Future - Production system in containment | PGGRC-Pastoral Greenhouse Gases Research Consortia | \$ 2,580,000 | 01/07/2020 | 31/12/2021 | AgResearch | No analysis has been completed for this project  | See 12991X02 above   |
|            |  |   | Victoria University - Wellington                   | \$ 8,000     |            |            |            |  |  |
|            |  |   | Total Revenue:                                     | \$ 2,588,000 |            |            |            |  |  |
| PRJ0279788 | Rhizobium technology                               | Research Tool                             | Kiwi Innovation Network Limited                    | \$ 104,000   | 09/11/2020 | 30/06/2023 | AgResearch | No analysis has been completed for this project  | Provision of more effective rhizobium isolates and improved delivery systems will stimulate farmers to reduce N fertiliser input while still maintain the pasture production. This technology has possible environmental benefits, through directly reducing cost to make fertilisers and reducing potential run off from fertiliser application. Biological N fixation is the most sustainable N source and 100% useage by legume plants. |
|            |  |   | KIWINET  | \$ 33,000    |            |            |            |  |  |
|            |  |   | PreSeed (AgResearch Internal Fund)                 | \$ 263,000   |            |            |            |  |  |
|            |  |   | Total Revenue:                                     | \$ 400,000   |            |            |            |  |  |
| PRJ0361322 | Gibberellins in HiCT white clover                  | Future - Full Release                     | Grasslanz Technology Limited                       | \$ 275,000   | 02/05/2021 | 30/06/2024 | AgResearch | See PRJ0187198 above   | See PRJ0187198 above   |
|            |  |   | Total Revenue:                                     | \$ 275,000   |            |            |            |  |  |
| PRJ0376852 | Quality control - Mycorhiza product from Grasslanz | Research Tool                             | Grasslanz Technology Limited                       | \$ 12,000    | 01/07/2021 | 31/03/2022 | Partner    | No analysis has been completed for this project  | This was commercial fee for service QC testing for Grasslanz Technology. Mycorhiza enhance nutrient and water uptake in host plants.   |
|            |  |   | Total Revenue:                                     | \$ 12,000    |            |            |            |  |  |
| PRJ0404396 | Methane vaccine Sept - Dec 2021                    | Future - Production system                | AgResearch (Internal)                              | \$ 280,000   | 01/09/2021 | 31/03/2024 | Partner    | No analysis has been completed for this project  | At least 20% reduction (He Waka Eke Noa aims   |

