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Road Miles Associated with Agricultural Production

Caroline Saunders
Eva Zellman

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Introduction

Road Transport Forum NZ (RTFNZ) is the national industry organisation representing the interests of the road transport industry, with the aim to build an efficient and cost effective road transport sector that will enable New Zealand industry, businesses and communities to prosper.

RTFNZ has identified that the transportation associated with agricultural production in New Zealand has not been subject to much analysis. Considering agricultural production is the backbone of the New Zealand economy, there is a need for better understanding of road usage in agriculture to ensure producers' roading needs are met.

AERU was commissioned by the E J Brenan Memorial Trust to estimate the road transport distances of inputs to farms and also transport off farm to processors. Road transport is the main, if not sole means, of moving agricultural goods onto and off farm. The yearly transportation distances for different farm inputs and farm outputs are estimated for the New Zealand kiwifruit, sheep and beef, and dairy sectors. An estimated total transportation distance for these inputs and outputs are provided for each agricultural sector as well as for all three sectors combined.

This report also presents output and financial data for each of the three sectors. This data is included in the report so that road transportation can be presented as a percentage of farm income and/or cost.

Methodology

Road transportation distances

Data sources

The data used to estimate the yearly road transportation distances for farm inputs and outputs were obtained from a number of different sources. A large part of the data comes from existing work in the AERU which has been collected through the Agricultural Research Group on Sustainability (ARGOS) programme. ARGOS is a six-year project investigating ecological, economic and social sustainability in the kiwifruit, sheep and beef, dairy, and high country sectors. In each sector, farms with different management systems have been organised in clusters matched on the physical characteristics of the farms, such as climate and soils. For the kiwifruit sector, the management systems are 'Green' (Hayward variety grown conventionally), 'Organic' (Hayward grown organically) and 'Gold' (the newer Hort16A variety grown conventionally). In sheep and beef, the management systems refer to whether a farm uses a 'conventional', 'organic' or 'integrated' pest management system; and in the dairy sector, the management systems refer to whether farm uses a 'conventional' management system or are converting to organic. The ARGOS project is in its fourth year, and detailed information on economic, ecological and social indicators have been collected for each farm, which has enabled the construction of a large database.

The ARGOS database includes information about the percentage of different inputs obtained from four different distance ranges: (1) 0-50 km; (2) 50-150 km; (3) over 150 km; and (4) from overseas (this data was collected in 2007). In this study, the mid point values for distance ranges (1) and (2) were used, 25 km and 100 km respectively; and 250 km was the value used for distance range (3) and (4). Note that the overseas supply of inputs involves road transportation from the port to the farm in New Zealand, which was estimated to be on average 250 km. The inputs available in the database include chemicals; fertilisers, veterinary supplies, seeds and feed. For the kiwifruit sector, only the chemical and fertiliser inputs are relevant. The distance range for feed was only available for the dairy sector. The weighted average for each input was calculated to obtain an overall distance value for each input and then doubled to attain the return distance from the farm to the input supplier. It is important to note that data from the farms that use/converting to an organic management system were not included because they do not tend to buy many of these inputs, or they buy specific inputs for organic farming. In addition, organic farms are only a small representation of all farms in New Zealand. As a result, data was obtained from 22 kiwifruit orchards; 21 sheep and beef farms; and 15 dairy farms.

Data on the distance outputs have to travel from the farm to the processing facility were obtained from different sources for each sector. For the kiwifruit sector, information showing which packhouse(s) 18 ARGOS kiwifruit orchards supply their fruit to was obtained from Zespri and the address of the ARGOS orchards was extracted from the ARGOS database. Some of the orchards supply more than one packhouse and the distance to each packhouse was calculated for these orchards. The "Wises Maps" web map directory (www.wises.co.nz) was used to determine the distance from each ARGOS orchard to the packhouse(s). For the sheep and beef sector, the distance from 21 ARGOS sheep and beef farms to their nearest processing plant and wool depot was obtained from the ARGOS database. Data for the dairy sector was obtained from AgriLINK NZ (2005), which shows an estimated dairy tanker roundtrip per farm.

Estimates of the number of times different inputs are purchased per year and the number of times output is transported to processing facilities every year were made by a survey of farmers. For the kiwifruit sector, we received estimates from the ARGOS Kiwifruit Research Field Officer who works closely with kiwifruit orchardists, and an experienced and highly regarded orchardist. There does not appear to be a lot of variability between different orchards on how often they purchase inputs and deliver their fruit to packhouses. On the other hand, the variability is much greater for dairy and sheep and beef farms because there are a number of operational management factors influencing the required inputs and associated outputs. For this reason, we surveyed 10 sheep and beef farmers and 10 dairy farmers using conventional management systems. We enquired how many times per year they purchase inputs and have outputs delivered to processing facilities.

The ARGOS database also contains data on the distance farmers need to travel to the following four amenities: source of general household supplies; their bank; nearest post office; and medical services. There is no information available indicating how many times per year trips to these amenities are undertaken. This information is not directly linked to agricultural production, but provides an insight into travelling requirements farmers have for other needs.

Sample representativeness

As described above, most of the data obtained is data from farms participating in the ARGOS project. Research conducted by Fairweather et al. (2007) shows that ARGOS farms are good representatives of New Zealand farms in general. Their study compared survey data on social and demographic variables between ARGOS farms from the three sectors (kiwifruit, sheep and beef, and dairy) with non-ARGOS farms from the respective sectors. Whilst ARGOS farms are generally representative of New Zealand farms, it is important to note that all the ARGOS dairy farms are located in the North Island and all the sheep and beef farms are located in the South Island. Hence, caution must be taken when inferring travelling distances for all New Zealand farms for these two sectors.

To obtain estimates for all farms in New Zealand for each sector and as a whole, data from Statistics New Zealand's 2002 Agricultural Production Survey was used (MAF, 2002a). This data shows total number of farms per sector, region and a total for the whole of New Zealand. Note that this data is from 2002 and may not accurately represent the number of farms per sector today[1].

Cross-reference data

The analysis of the data described above was cross-referenced with other data sources. The orchard to packhouse transportation distances was cross-referenced with data obtained from AgriLINK NZ (2005). The data for the sheep and beef sector was cross-referenced with data collected by Meat & Wool New Zealand Economic Services (2007) showing the average distance from sheep and beef farms to their (1) nearest wool depot, (2) export sheep processing plant, (3) export beef plant, and (4) fertiliser works. Their data show values for eight different sheep and beef farm types in the North Island and the South Island such as high country, hill country, intensive finishing and mixed finishing.

The Ministry of Agriculture and Forestry's (2000) Monitoring Reports (www.maf.govt.nz) provide data on average total on road kilometres travelled in a year for kiwifruit orchardists,

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[1] Data from the 2007 Agricultural Production Survey is not available until April 2008.

sheep and beef farmers and dairy farmers in New Zealand. This includes the kilometres travelled by the farming family for business purposes but also includes personal travel. These data are used as a cross-reference for all three sectors.

Caution must be applied in interpreting these results because of small sample sizes and large variability in some data sets. It is also important to note that the estimates in this report are conservative. That is, in general, the lowest values have been used when presented with a range of values.

Output and financial information

Output and financial data for the 05/06 financial year were obtained from different sources for each sector.

For the kiwifruit sector, average per orchard output, income and cost measures were obtained from the Ministry of Agriculture and Forestry's (2006) Horticulture Farm Monitoring Report. This report covers kiwifruit orchards in the Bay of Plenty, which produces 80 percent of New Zealand's kiwifruit crop.

Average per farm output, income and cost measures for the sheep and beef sector were obtained from Meat & Wool New Zealand Economic Services' Farm Survey (2007a). For the dairy sector, average per farm output and financial data were acquired from Dexcel.

The output data include measures relevant to each sector as well as per effective area measures. Gross farm/orchard revenue is presented as an income measure for each sector. Orchard gate return is also presented as an income measure for the kiwifruit sector. Gross orchard revenue covers income from all sources, whilst orchard gate return only includes income from kiwifruit. Two cost measures are included for each sector: cash farm/orchard expenditure and total working expenses. Cash farm/orchard expenditure includes all cash farm expenses except interest and rates, and is the cost measure used by MAF. Total working expenses is the cost measure used by Meat & Wool New Zealand and excludes all standing charges (e.g. depreciation, insurance, administration etc).

Results

Road transportation distances

The results on road transportation distances are organised by sector. The estimated road distances for inputs and outputs are presented separately and together both on a per farm basis and for New Zealand as a whole. How well the estimates correspond with cross-reference data is also discussed. Combined estimates for all three sectors are presented in the last part of the result section. In addition, the distance farmers need to travel for the four amenities are reported.

Kiwifruit sector

The average per kiwifruit orchard road transportation distance for chemical and fertiliser inputs is estimated at 640 km per year. The estimated return trip distance for chemicals is 50 km and it is estimated that this input is purchased seven times per year, resulting in a total of 350 km per year. For fertilisers, the estimated return trip distance is 96.70 km and fertilisers are estimated to be purchased three times per year, resulting in a total of 290 km per year.

The average per orchard return road transportation distance from the orchard to the packhouse(s) is estimated at 93 km per year. Note that it is assumed that kiwifruit is transported to packhouse(s) one time per year. There was some variability in this data.

The average per orchard return road transportation distance for inputs (chemicals and fertilisers) and outputs is 733 km per year. The average total road transportation distance for inputs and outputs for all orchards in New Zealand[2] are presented in Table 1.

Table 1: Total New Zealand road transportation distances for selected orchard inputs and outputs.

Transportation requirements	Distance (km)
Road transportation distance for inputs (chemicals and fertilisers)	1,472,261
Road transportation distance for outputs (orchard to packhouse(s))	214,411
Total road transportation distance for inputs and outputs	1,472,261

Data from AgriLINK NZ (2005) indicate that the average one-way distance between an orchard and packhouse is 15 km but the estimated distance in this study is 46 km. One reason for the discrepancy between the data in this report at the data from AgriLINK NZ (2005) is that this report accounts for some orchardists supplying kiwifruit to more than one packhouse per year. However, even when this difference is taken into account, the packhouse transportation distances in this study is somewhat longer than in AgriLINK NZ's (2005) data.

The MAF Farm Monitoring Report for horticulture shows that the average total road kilometres travelled by kiwifruit orchardists in New Zealand is 37,088 per orchard per year. The estimated road transportation distances in this report is much lower, which is expected as only a couple inputs are included. In addition, the Farm Monitoring Report data is also likely to include kilometres travelled for private purposes.

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[2] There are 2300 kiwifruit orchards in New Zealand.

Sheep and beef sector

The average per farm road transportation distance for four inputs (chemicals, fertilisers, veterinary supplies, and seed) is estimated at 2,662 km per year. The estimated return trip distance for chemicals is 95 km; fertilisers 85 km; veterinary supplies 74 km; and seeds 94 km. The estimated number of times per year these inputs are purchased is 7.5; 8; 10.5; and 53.5 respectively[3][4].

The average per farm return road transportation distance from the farm to the nearest processing facility[5] is estimated at 2,090 km per year. The estimated average return distance from farm to the nearest processing facility is 106.5 km and it is estimated that stock are transported to a processing facility 20 times per year[6]. The average per farm return road transportation distance from the farm to the nearest wool depot is estimated at 117 km per year. The estimated average return distance from farm to the wool depot is 117 km as it is estimated that wool is transported one time per year.

The total average per farm return road transportation distance for inputs (chemicals, fertilisers, veterinary supplies, seeds) and outputs (processing facility and wool depot) is 4,869 km per year.

As mentioned in the method section, the sheep and beef farm sample is drawn from South Island farms and the average total return road transportation distance for inputs and outputs for all sheep and beef farms in the South Island[7] is presented in Table 2. The average total road transportation distance for inputs and outputs for all sheep and beef farms in New Zealand[7] is also presented in Table 2.

Table 2: Total South Island and New Zealand sheep and beef farm road transportation distances for selected inputs and outputs.

	Distance (km)	
Transportation requirements	**South Island Sheep & Beef Farms**	**New Zealand Sheep & Beef Farms**
Road transportation distance for inputs	30,372, 476	75,199,164
Road transportation distance for outputs	25,178,226	62,338,730
Total road transportation distance for inputs and outputs	55,550,703	137,537,893

When the data in this report is cross-referenced with data from Meat & Wool New Zealand Economic Services (2007), it shows that the data on the distance to nearest processing facility correspond well with Meat & Wool's data on the distance between sheep and beef farms in the South Island low lands to export sheep plants and export beef plants. Meat & Wool's data indicates that there are greater road transportation distances for high country and hill country farms. Hence, our estimates are conservative when generalised to the whole of the South Island and New Zealand. The cross-reference data from Meat & Wool New Zealand also

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[3] Separate trips are not always made when purchasing these inputs. They are sometimes bought when making a trip to town for other reasons.

[4] Caution should be taken when interpreting these results because of high variability in the data set.

[5] Stock may not be transported to the nearest processing facility. The processing facility stock are transported to depends on factors such as the type of stock and processing facility availability. Hence, this is a conservative estimate.

[6] There is a lot of variability in this data because distances to nearest processing facilities and the number of times per year stock are transported varies a lot between farms.

[7] There are a total of 11,410 sheep and beef farms in the South Island and 28,250 in New Zealand.

shows that the data on distance to nearest wool depot in this report is also slightly underestimated, and so is the data on distance to fertiliser supplier.

The MAF Farm Monitoring Report for sheep and beef farms shows that the average total road kilometres travelled by sheep and beef farmers in New Zealand is 33,068 per farm per year. As expected, the estimated road transportation distances for inputs in this report is much lower because only four inputs are included in this report.

Dairy sector

The average per farm road transportation distance for five inputs (chemicals, fertilisers, veterinary supplies, seed, and feed) is estimated at 2,110 km per year. The estimated return trip distance for chemicals is 50 km; fertilisers 87.50 km; veterinary supplies 50 km; seed 50 km; and feed 75 km. The estimated number of times per year these inputs are purchased is 3; 8 .5; 2; 10.5; and 7.50 respectively[8][9].

The average per farm return road transportation distance from the farm to the nearest milk processing facility[10] is estimated at 4,448 km per year. The estimated average return distance from farm to the nearest processing facility is 18 km and it is estimated that milk is transported to a processing facility 247 times per year.

The total average per farm returns road transportation distance for inputs (chemicals, fertilisers, veterinary supplies, seed, and feed) and outputs (processing facility) is 6,557 km per year.

The average total return road transportation distance for inputs and outputs for all farms in the North Island and in the whole of New Zealand is presented in Table 3[11]. The table presents the data for the North Island individually because the ARGOS dairy farms are based in the North Island. The distances in the South Island may be a longer than in the North Island so caution must be taken when considering the average total transportation distances for all dairy farms in New Zealand.

Table 3: Total North Island and New Zealand dairy farm road transportation distances for selected inputs and outputs.

Transportation requirements	Distance (km)	
	North Island Dairy Farms	New Zealand Dairy Farms
Road transportation distance for inputs	25,315,000	30,588,958
Road transportation distance for outputs	53,373,6000	64,493,100
Total road transportation distance for inputs and outputs	78,688,600	95,082,058

The MAF Farm Monitoring Report for dairy farms shows that the average total road kilometres travelled by dairy farmers in New Zealand is 32,812 per farm per year. As with the other two sectors, the estimated road transportation distances for inputs in this report is much lower because only five inputs are included in this report.

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[8] Separate trips are not always made when purchasing these inputs. They are sometimes bought when making a trip to town for other reasons.
[9] Caution should be taken when interpreting these results because of high variability in the data set.
[10] The milk may not be transported to the nearest milk processing facility. Hence, this is a conservative estimate.
[11] There are 12,000 dairy farms in the North Island and 14,500 in the whole of New Zealand.

The average total road transportation distance for inputs and outputs for all farms/orchards in the three sectors in New Zealand is displayed in Table 4. Note that different number of inputs and outputs are measured for each sector, hence, it is not appropriate to compare the sectors on these estimates. It is also important to note that there are almost twice as many sheep and beef farms than dairy farms and 12 times as sheep and beef farms than kiwifruit orchards in New Zealand. However, the estimated total for all sectors provide a good indication of road transportation distances for selected inputs and outputs for a large part of New Zealand's agricultural production industry. The kiwifruit, sheep and beef, and dairy sectors combined cover 80 percent of total agricultural production land use in New Zealand (MAF, 2002b[12]).

Table 4: Average total road transportation distances for selected inputs and outputs for each sector and all sectors combined.

Agricultural sector	Total transportation distances (km)
Kiwi fruit	1,686,672
Sheep and beef	137,537,893
Dairy	95,082,058
Total all sectors	234,306,624

The average estimated return distance farmers need to travel to the following four amenities: source of general household supplies; their bank; nearest post office; and medical services are presented in Table 5. These data only indicate the return trip distance and do not provide an indication of how many times per year trips to these amenities are undertaken. This information is not directly linked to agricultural production, but provides an insight into travelling requirements farmers have for private needs.

Table 5: Average estimated return road distance four amenities for kiwifruit, sheep and beef, and dairy farmers, and combined average estimate for all three sectors.

Sector	Household Supplies	Bank	Post Office	Medical Services
Kiwifruit	22.20	21.50	21.50	23.80
Sheep and Beef	128.90	72.00	50.20	41.30
Dairy	34.00	54.90	27.80	30.60
Average across all sectors	66.70	48.10	34.10	32.10

The estimated road distances for the four amenities are shortest for the kiwifruit sector and longest for the sheep and beef sector. This is expected because sheep and beef farms tend to be more remote than dairy farms and kiwifruit orchards.

Output and financial information

Average per orchard/farm output, income and cost measures for each sector are displayed in Table 6.

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[12] Note this data is old and may not accurately represent land use by farm type today. Data from the 2007 Agricultural Production Survey is not available until April 2008.

Table 6: Average per farm/orchard output, income and cost measures for the kiwifruit, sheep and beef, and dairy sectors.

Sector	Measures	Average per farm/orchard
Kiwifruit		
Output measures	Export/Class 1 Trays	39,525
	Total Effective Area	5 ha
Income measures	Orchard Gate Return	$148,360
	Gross Orchard Revenue	$152,810
Cost measures	Cash Farm Expenditure	$123,840
	Total Working Expenses (excl. standing charges)	$ 116,290
Sheep and Beef		
Output measure	Stock Units	4274
	Total Effective Area	340 ha
Income measure	Gross Farm Revenue	$301,017
Outcome measures	Cash Farm Expenditure	$187,308
	Total Working Expenses (excl. standing charges)	$171,240
Dairy		
Output measures	Milk Solids Sold	116,186 kg
	Cows Milked	324
	Effective Hectares	113.4 ha
Income measure	Gross Farm Revenue	$515,269
Cost measures	Cash Farm Expenditure	$303,110
	Total Working Expenses (excl. standing charges)	$288,189

Conclusion

This study has estimated the road usage associated with key agricultural sectors in New Zealand. It has concentrated on the dairy, sheep and beef and kiwifruit sectors which account for 80 percent of New Zealand's agricultural land use. The estimates have to be interpreted with some caution given the relatively small sample sizes and large variability in data. However, these data, when cross-referenced with other sources, seem to be robust and generally underestimates were used. Results of the study show 234 million kilometres per year is associated with agriculture.

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