Producing more without getting more productive

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Highlights

- In the 2023/24 season New Zealand dairy farms are producing more milksolids per cow and per farm than ever before, but sector total factor productivity has been broadly flat since 2012/13.
- The difference reflects input intensity. Since 2012/13, additional output has increasingly been supported by increasing reliance on purchased feed, fertilisers and labour resulting in flat productivity trend.
- Flat productivity is better read as robustness through a difficult decade, but future competitiveness will depend on lifting pasture utilisation and input efficiency rather than simply spending more to produce more.

Keywords: dairy farming, pasture utilisation, profitability, supplementary feed, total factor productivity

Scope and evidence base

This perspective draws on farm physical and financial KPIs from DairyBase[1], New Zealand Dairy Statistics, the DairyNZ Economic Survey (DairyNZ 2025), and peer-reviewed literature on productivity, pasture systems, and climate resilience. The figures combine published time-series data with descriptive indices to illustrate broad system changes over time rather than estimate causal effects. The productivity index is constructed from 2012/13 onward, statements about sector productivity refer to that period. Where this perspective refers to earlier structural change, it draws on the physical and financial series, which extend back further.

Unless otherwise stated, the figures use published annual series from New Zealand Dairy Statistics and the DairyNZ Economic Survey (DairyNZ 2025). Consistent with Marmont et al. (2025), physical variables are presented in their original units, and monetary variables are converted to real terms using the Consumer Price Index and indexed by dividing each season's value by the base-year observation. Throughout, we refer to pasture and crops harvested; some cited studies use related measures, including pasture eaten, which are not identical.

Introduction

Milksolids per cow and per farm have risen steadily in New Zealand dairy, yet sector level productivity has shown no net gain since 2012/13 (Fernandez et al. 2026). These trends are not contradictory but the gap between them matters. Biological or managerial gains, including higher feed intake per cow, may continue to lift output per cow while whole-sector productivity stagnates if those gains require a larger or more expensive input bundle. Figure 1 shows this directly: while milksolids per cow has trended upward, the total factor productivity index has oscillated around unity with no clear trend. The index is constructed relative to 2012/13, so what matters is movement away from that base rather than the level itself. Year-to-year variation largely reflects seasonal conditions and price-driven input use rather than shifts in the production frontier. Productivity performance is therefore more appropriately assessed over the long run. On that basis we read the record as showing neither sustained growth nor sustained decline: the index ends close to where it began, and the movements in between are not maintained in either direction. The central message is not that output growth has stopped, but that efficiency growth has. The difference lies in what each measure counts. Output per cow is a partial productivity indicator: it captures one output relative to one input and says nothing about what else was used to achieve it. Total factor productivity relates output to the full set of inputs, including land, labour, feed, capital and services (O'Donnell 2010). To illustrate, a farm that lifts output per cow by 10% by feeding 20% more purchased supplement has improved a partial measure while reducing total factor productivity, because the extra output cost more than it returned. A sector can therefore produce more while becoming less efficient, if the inputs it uses grow faster than the output it produces.

That distinction is not merely technical. Recent Dairy Statistics show near-record milksolids production per cow and per herd despite fewer cows, while the DairyNZ Economic Survey shows rising output alongside higher feed expenditure and lower financial returns (DairyNZ 2025; DairyNZ and LIC 2025; Marmont et al. 2025). This perspective asks what lies behind that divergence,

[1]DairyBase is DairyNZ's farm benchmarking platform, which compiles participating farms' physical and financial performance data to track performance over time and compare it with peer and industry benchmarks.

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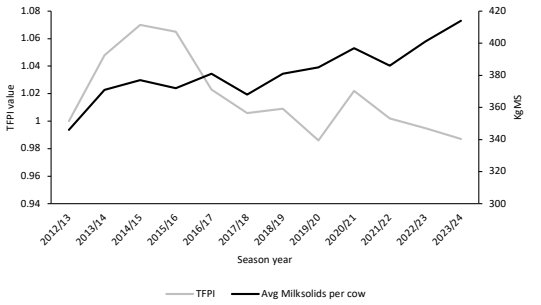


Figure 1 Total factor productivity index and average milksolids per cow in New Zealand dairy since 2012/13. The productivity series is indexed to 2012/13 = 1.0. TFPI source: Fernandez et al. (2026), following O'Donnell (2010). Milksolids per cow source: DairyNZ and LIC (2025).

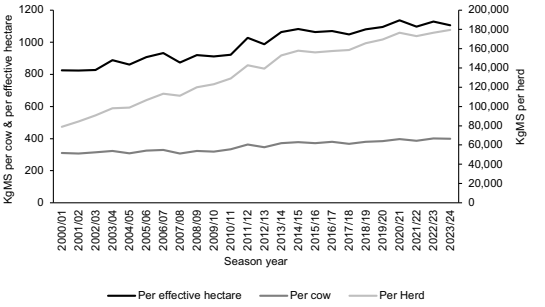


Figure 2 Trends in average milksolids production per hectare, per cow and per herd since 2000/01. Source: DairyNZ and LIC (2025).

beginning with how the New Zealand dairy production system has evolved over time.

Structural shifts in the production system

The New Zealand dairy sector has achieved major gains through scale and intensification. The average farm grew from 92 cows on 59 ha in the 1960s to over 410 cows on 143 ha in the 2020s, while milksolids per cow rose from about 237 to more than 400 kg MS/cow and milksolids per hectare from 357 to 1,199 kg MS/ha over the same period (Marmont et al. 2025). For several decades, these physical changes lifted both output and productivity.

These gains were not driven by scale alone. For much of the late twentieth century, growth was underpinned by research that improved our understanding of the on-farm biophysical system, and the resulting rise in pasture eaten per hectare allowed output to expand faster than the inputs used to produce it (Macdonald and Roche 2024). That pasture-based efficiency engine slowed after 2001/02. Gains in pasture and crop eaten fell from about 133 kg DM/ha/yr over 1990/91–2001/02 to about 27 kg DM/ha/yr over 2002/03–2019/20, and have since turned negative in some regions, even as nitrogen fertiliser use, irrigation and other intensification levers continued to expand (Mills and Neal 2021; Marmont et al. 2024; Chapman et al. 2025). Arguably, in a pasture-based system approaching its biophysical limits, further growth is difficult without increasing reliance on imported supplements. That increasing reliance has marked a fundamental change in the productivity dynamics of the sector.

Figure 2 shows that output per cow, hectare, and herd has continued to rise. The slowing of gains in pasture and crop eaten did not stop production growth. Instead, it changed the pathway through which growth was achieved. From the early 2000s onward, additional output came increasingly from a more input-intensive system rather than from the earlier combination of scale expansion and gains in pasture-based efficiency.

Input intensity and the pasture advantage

From a productivity perspective, the distinction between growth led by pasture and crop eaten and growth led by purchased inputs is critical. TFP increases when output rises faster than the inputs. When additional output is matched by proportionally higher expenditure on feed, labour, capital, and compliance, TFP stagnates.

Supplements and imported feed have long had a place in New Zealand dairy as they can lift milksolids production and profitability when used alongside high pasture utilisation to fill feed deficits (Penno et al. 1996). The question is not whether they work biologically but whether they improve whole-farm efficiency once substitution effects, feed price risk, and system costs are accounted for. The TFP evidence suggests they largely have not (Fernandez et al. 2026).

That distinction matters more now than during the expansion phase of the 1990s. The DairyNZ Economic Survey data shows pasture and supplement expenditure rising faster than stocking rate, especially since 2000 (DairyNZ 2025). Northland farmlet evidence finds that higher-input systems produce more milk but no higher average operating profit than lower-input pasture systems (Kay et al. 2023; Marmont et al. 2025). That is, higher output has not automatically meant higher efficiency or higher profit. Similar results were reported by Silva-Villacorta et al. (2005) in an analysis of dairy farms with different levels of supplement input, where, on average, high input farms achieved equivalent operating profit to low input farms.

Figures 3 and 4 point to the mechanism. Stocking rate has been broadly stable over two decades, but real pasture and supplement expenditure per hectare has continued to rise (Figure 3). Over the same period, both real income and expenditure have grown,



Figure 3 Indexed stocking rate and indexed real pasture and supplement expenditure per hectare since 2000/01 (2000/01 = 1.0). Stocking rate was calculated as cows milked per effective hectare. Monetary series from the DairyNZ Economic Survey *(DairyNZ 2025)* were converted to real terms using the Consumer Price Index and indexed by dividing each season's value by the 2000/01 observation, following the descriptive index approach used in Marmont et al. (2025).

with expenditure rising faster (Figure 4). Together, the figures show a system in which producing each additional unit of output has become more expensive, which is the pattern that a flat TFP record would lead one to expect.

The issue is not supplements themselves, they are valuable tactical tools when pasture growth is constrained, or seasonal feed supply is uneven. The risk arises when tactical becomes structural, when low-cost pasture is replaced on a sustained basis by higher-cost purchased feed, pasture-based cost advantage erodes for the sector. This is why pasture eaten remains strategically important. Higher pasture and crop eaten is consistently associated with better profitability, and better information on paddock pasture mass improves grazing decisions and operating profit (Beukes et al. 2015; Neal et al. 2019; Thorrold 2024).

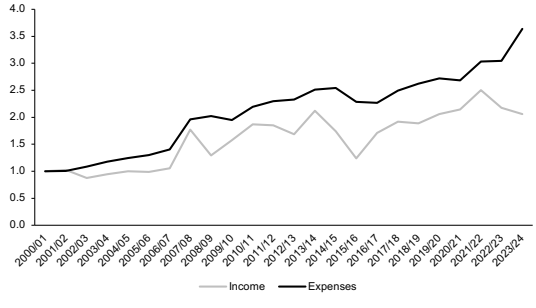


Figure 4 Indexed real net dairy cash income and total dairy cash expenses since 2000/01 (2000/01 = 1.0). Nominal series from the DairyNZ Economic Survey *(DairyNZ 2025)* were converted to real terms using the Consumer Price Index and indexed by dividing each season's value by the base-year observation, consistent with Marmont et al. (2025).

Productivity, prices and financial performance

Flat TFP is not an abstract result; but nor does it determine farm financial performance on its own. Profitability changes for two separable reasons: because the physical productivity of the system changes, and because the prices received for output move relative to the prices paid for inputs (O'Donnell 2010).

The significance of flat TFP is what it removes. When productivity is rising, a farm system can absorb a fall in payout or a rise in feed and fertiliser prices without margins necessarily collapsing, because it is getting more output from the same resources. When productivity is flat, that buffer is gone and financial performance tracks prices more directly. Rising input intensity sharpens the exposure further: the larger the share of feed that is purchased rather than grown, the more the margin depends on input prices set outside the farm gate.

Figure 5 makes this visible. Return on assets, return on equity, and return on dairy assets have all trended downward over the long run, converging towards approximately 5% (Marmont et al. 2025). These measures ask slightly different questions: what the business earns on everything invested in it, what the owner earns on their own capital, and what the dairy operation earns on the assets used for dairying. Part of the long-run decline in all three may reflect rising asset values rather than falling farm earnings, so they should not be read as productivity measures. What they do show is that returns have become both thinner and more variable, which is consistent with a sector facing higher input costs and a less flexible cost structure.

Debt taken on during the expansion phase compounds that exposure. Borrowing was rational when scale gains and stronger returns were available, but it leaves less room for error once margins are compressed and productivity is no longer adding to them. In this environment the objective is not simply to produce more, but to produce more from the same or a smaller

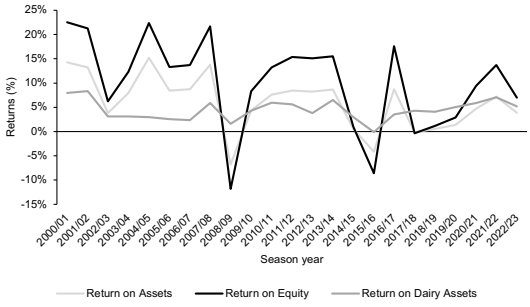


Figure 5 Returns on dairying in New Zealand, showing return on assets, return on equity and return on dairy assets. Source: DairyNZ Economic Survey *(DairyNZ 2025)* and Marmont et al. (2025).

set of inputs. That is what TFP measures, and it is where the sector has stalled.

From robustness to renewed productivity

Flat productivity should not be read simply as failure. The sector has absorbed payout shocks, labour shortages, regulatory tightening (e.g. freshwater regulations), and increasingly difficult climatic conditions (e.g. droughts). Recent work shows that warming and drought severity have intensified in key dairying regions, while declining pasture harvest already imposes measurable economic costs in Northland and Waikato (Marmont et al. 2024; Tait-Jamieson et al. 2025). Holding productivity broadly steady against that backdrop is evidence of robustness, one of the three capacities that the resilience literature identifies alongside adaptability and transformability (Meuwissen et al. 2019).

But robustness is not the whole of resilience. The TFP decomposition is instructive here. Technological progress, meaning improvement in what is achievable from a given set of inputs, did occur, but it was concentrated in a single shift around 2014/15 and has been flat since. Scale and mix efficiency, meaning how well farms are sized and how inputs are selected and combined, has deteriorated gradually, and environmental performance has declined slightly (Fernandez et al. 2026). These components largely offset one another, which is why the aggregate index remains close to its 2012/13 base with no clear long-run trend. The decomposition therefore explains the flat record rather than contradicting it. Together these mean the sector has absorbed shocks without restructuring the input base that generates them, a pattern consistent with robustness but not with the adaptability or transformability that sustained competitive performance requires. We note that efficiency and robustness are not automatically complementary, and that a system optimised narrowly for input efficiency may carry less slack against shocks. Our point is the narrower one that the sector has absorbed shocks without shifting the production frontier, and we do not attempt to quantify any trade-off between the two.

A sector that maintains output by using progressively more expensive inputs will struggle to protect margins, absorb new regulation, and compete with alternative uses of capital. The strategic task is therefore to convert demonstrated robustness into renewed productivity growth, rebuilding from the feed base upward.

What the productivity record implies

Pasture remains the centre of dairy farming in New Zealand and there is no serious dispute that grazed pasture underpins national milk production and farm profitability (Thorrold 2024). What the productivity record adds is a condition on where sector level gains can come from next. This paper takes a sector perspective, and it does not identify the best system for any individual farm. Farms differ in soils, climate, contour, scale, debt position and objectives, and profitable high-input and low-input systems both exist. What the sector perspective does say is that the sector as a whole has not converted additional input use into additional productivity. Three implications follow.

- **Feed grown on farm remains the lever with the most leverage.** Pasture is the input the sector controls most directly, and it is closely tied to system productivity and profitability (Neal and Roche 2019). Where persistence, grazing management or forage choice are constraining harvested feed, addressing them raises productivity and profitability without necessarily raising the input bundle (Chapman et al. 2025; Marmont et al. 2024).
- **The production effect of supplements is clearer in the record than the productivity effect.** Supplements lift milksolids production and used tactically they manage genuine pasture deficits. What the sector perspective shows is that the sector has not, on average, converted a rising share of purchased feed into rising productivity, and farmlet evidence points the same way on profit (Kay et al. 2023; Penno et al. 1996). Whether that holds on any farm depends on its feed conversion, its pasture base and the prices it faces.
- **Adopt technology with economic discipline.** Invest in tools that improve feed allocation, pasture measurement and decision quality, but judge them on whole-system productivity and profitability rather than on output per cow alone (Beukes et al. 2015; Neal et al. 2019).

Conclusions

New Zealand dairy farms are producing more per cow and more per farm than ever before, but output growth is not the same as productivity growth. Since 2012/13, each additional unit of output has required proportionally more inputs, and sector-level total factor productivity has been flat as a result.

That flat record reflects genuine robustness through a difficult decade of payout shocks, regulatory change, and climatic pressure. However, long-term competitiveness depends on restoring the pasture-based efficiency that historically gave New Zealand dairy its cost advantage, and on ensuring that future growth comes from doing more with the same resources rather than spending more to produce more. If competing suppliers continue to improve (e.g. United States; Njuki 2022), a flat index means ground lost, and New Zealand's advantage has always rested on converting grazed feed into milk more cheaply than systems that buy their feed.

The sector has demonstrated it can hold steady under

pressure. The task ahead is to convert that robustness into a new phase of genuine efficiency growth, one grounded in the feed system, measured by total factor productivity, and capable of sustaining margins through the next cycle of shocks. That frames the strategic question for the coming decade rather than answering it. Whether the sector can restore productivity growth from its feed base, and what that requires of farm systems, research investment and measurement, is the question this record puts on the table.

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