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Presidential Address

THE SHEEP AND CATTLE INDUSTRIES IN NEW ZEALAND

J. D. J. SCOTT

The publication "State of the Livestock Industry" prepared by the New Zealand Ministry of Agriculture and Fisheries in May 1976 should concern animal production scientists because research efforts were apparently of no benefit to the industry over the period 1968 to 1975 and if this state of affairs continued animal research on the current scale might not be justified.

The data presented showed that there had been only a minimal increase in the total livestock units carried on New Zealand farms since 1968 and that production per head had declined since about that time.

Data on livestock numbers (Economic Review of N.Z. Agriculture, 1976) and per-head performance (Department of Statistics, Meat Producers, Wool and Dairy Boards' Annual Reports 1966-75) are shown in Tables 1 and 2.

With the exception of sheep slaughter weights, which had declined since the 1950s, per-head performance was at or near peak levels in 1966.

With reduced per-head performance from relatively static numbers of livestock, total milkfat production in 1974-5 was 7% lower than in 1968-9, wool production 11% lower, and meat production 8% higher.

The State of the Livestock Industry report showed that the cessation of growth in numbers was associated with a decline in capital and developmental expenditure in the late 1960s and that dry seasons and insect depredations contributed to the fall-off in production per head. However, farm advisers estimated that livestock numbers could increase to 120 million, 23% above

TABLE 1: LIVESTOCK NUMBERS 1968-76 (millions)

	Dairy Cattle	Beef Cattle	Sheep	Stock Units
1968	3.7	4.6	60.5
1969	3.8	4.8	59.9
1970	3.7	5.1	60.3
1971	3.5	5.3	58.9
1972	3.4	5.4	60.9
1973	3.4	5.7	56.7
1974	3.3	6.1	55.9
1975	3.1	6.5	55.3
1976	3.0	6.8	56.3

TABLE 2: PERFORMANCE PER HEAD

	Lambing (%)	Ewe wt (kg)	Lamb wt (kg)	Wool/Sheep (kg)	MF/Cow at Pail (kg)
1966	99	22.9	14.2	5.8
1967	99	22.0	13.7	5.6
1968	95	21.0	13.2	5.5
1969	97	20.4	13.5	5.5
1970	93	19.8	13.2	5.5
1971	94	20.3	13.2	5.5
1972	92	20.0	13.2	5.5
1973	91	18.3	12.7	5.1
1974	93	19.5	13.1	5.0
1975	94	19.5	12.9	5.3
1976	98	19.8	13.7	5.6

the 1973 level, by 1985, and that there could also be improvements in per-head performance.

The purpose of my contribution is to look at the main physical and financial factors associated with the production changes, assess the influence of other forms of land usage, and discuss the possibility of meeting targets. Most of the examples quoted are from dairy farming because of the availability of data and my greater familiarity with this industry.

TABLE 3: AREAS OF IMPROVED AND UNIMPROVED PASTURES; STOCK NUMBERS

		1950	1955	1960	1965	1970
Area in sown pasture and fodder crops (m ha)	....	7.6	7.4	7.7	8.2	8.5
Unimproved occupied area (m ha)	....	9.3	9.5	9.4	8.8	8.1
Grassland topdressed (m ha)	....	2.3	3.3	3.6	5.2	5.7
Total stock units (m)*	....	57.6	67.0	75.0	85.1	100.5
Stock units/ha sown pasture and fodder crops†	....	7.2	8.6	9.2	9.9	11.3

*The actual increase in 1950-60 was 13 million sheep and 1 million cattle and in 1960-70, 13 million sheep and 2.8 million cattle.

†Calculated by deducting 3.0, 3.2, 3.5, 4.0 and 4.5 million stock units from total stock units in 1950, 1955, 1960, 1965 and 1970, respectively, to allow for those grazed on unimproved areas, and dividing the balances by the area in sown pasture and fodder crops. While this provides only an approximate estimate of carrying capacity, it gives an indication of the increase in intensity of stocking which occurred.

FARM DEVELOPMENT IN THE POST-WAR ERA

A better appreciation of the factors which have contributed to the recent decline in production can be obtained by examining developments in the post-war era. In Table 3, data on land development and livestock numbers are shown (Department of Statistics).

The major development during the period was the increase in area of grassland topdressed. Results of Cullen (1957), Yates (1971), and Suckling (1975) indicate that stocking rates can be increased by 5 to 10 stock units/ha 2 to 4 years after topdressing unimproved hill country pastures, suggesting that the application of fertilizer to such pastures would have enabled somewhere between 20 and 30 million more stock units to be run.

The 13% increase in the area of land developed and sown to pasture probably enabled another 10 million stock units to be carried.

The period, and particularly the 1960s, was also one in which there was considerable intensification in farming, and stocking rates were increased on many farms without additional inputs of developed land or newly topdressed areas. The most important elements of improved farming methods were probably better distribution of feed throughout the year and the correction of trace element deficiencies, although many other aspects were important in improving carrying capacities, production per head or per labour unit.

Running additional stock would have necessitated, or have been facilitated by, additional fencing, water supplies, tracks, buildings and machinery.

CESSATION IN GROWTH

The cessation in growth in livestock numbers and its association with pasture improvement can be seen better by tracing developments from 1966 onwards (Table 4) (Department of Statistics, MAF Fertiliser Statistics, N.Z. Meat and Wool Boards' Economic Service, 1976).

It can be seen that from 1967 to 1972 there was little overall change in either the areas available for livestock or the area top-dressed although stock numbers continued to increase from 1967 to 1969 under the impetus of previous development. In these circumstances it is not so surprising that stock numbers did not increase, especially as several dry seasons were experienced after 1967. Since 1972, however, it appears that some additional land

TABLE 4: AREAS OF IMPROVED AND UNIMPROVED PASTURES,
FERTILIZER USAGE AND STOCK NUMBERS

	<i>Area in Sown Pasture and Fodder Crops (m ha)</i>	<i>Grassland Topdressed and/or Limed (m ha)</i>	<i>Fertilizer Delivered (m t)</i>	<i>Total Stock Units (m)</i>
1966	8.3	5.3	2.01	90.4
1967	8.5	5.5	1.78	95.2
1968	8.4	5.0	1.61	98.2
1969	8.6	5.1	1.86	99.7
1970	8.5	5.7	1.95	100.5
1971	8.6	5.6	1.87	100.6
1972	8.7	5.7	2.03	99.3
1973	8.7	7.2*	2.54	102.5
1974	9.1	7.5*	2.57	99.8
1975		5.4*	1.73	99.8

*Estimate

TABLE 5: GROSS AND NET INCOMES AND EXPENDITURE ON
PASTURE IMPROVEMENT ON SHEEP FARMS

		<i>Gross Income (\$)</i>	<i>Net Income (\$)</i>	<i>Pasture Improvement Expenditure (\$)</i>
1965-66	....	18 243	5 987	6 584
1966-67	....	16 747	4 226	6 495
1967-68	....	16 520	4 778	5 797
1968-69	....	19 230	5 956	6 730
1969-70	....	20 540	6 338	7 146
1970-71	....	20 226	5 822	6 993
1971-72	....	22 941	7 108	7 621
1972-73	....	39 307	18 819	10 347
1973-74	....	38 198	14 258	12 374

TABLE 6: GROSS AND NET INCOMES AND EXPENDITURE ON
PASTURE IMPROVEMENT ON DAIRY FARMS

		<i>Gross Income (\$)</i>	<i>Net Income (\$)</i>	<i>Pasture Improvement Expenditure (\$)</i>
1965-66	....	10 543	4 176	3 307
1966-67	....	12 053	4 676	3 779
1967-68	....	12 076	4 273	3 943
1968-69	....	11 775	4 069	3 746
1969-70	....	12 615	4 424	3 998
1970-71	....	13 939	4 838	4 433
1971-72	....	18 682	7 318	5 631
1972-73	....	21 283	8 321	6 674
1973 74	....	22 853	8 751	7 209

has been developed and there has been a major increase in fertilizer usage, particularly on hill country.

EFFECT OF INCOMES

As was pointed out in the State of the Livestock Industry report, the major reason for the cessation of land improvement from 1968 until 1972 or 1973 was the relatively static gross incomes of both sheep and dairy farmers. Despite accepting low net incomes, little money was available for capital developments. Gross and net incomes and the amounts spent on items partly or wholly associated with pasture improvement and land development (fertilizer, seed, vehicles, repairs and maintenance and wages) are shown in Tables 5 and 6 (N.Z. Meat and Wool Boards' Economic Service, 1976; N.Z. Dairy Board, 1975).

In general, low incomes prevented any real increase in land development or pasture improvement expenditure until the 1972-3 season on sheep farms and possibly 1971-2 on dairy farms.

While in general low incomes could reasonably be considered to have been a major contributory factor to the stagnation in production, they were by no means entirely responsible as is indicated by data (Table 7) on expenditure and production on Northland and South Auckland dairy farms (N.Z. Dairy Board Economic Survey, 1975).

TABLE 7: EXPENDITURE AND PRODUCTION ON NORTHLAND AND SOUTH AUCKLAND FARMS

	Farm Expenditure/ha (\$)		kg Milkfat/ha	
	Total Farm + Run-off Area		Total Farm Area	
	Northland	South Auckland	Northland	South Auckland
1966-67	57	126	132
1967-68	60	127	125
1968-69	59	117	131
1969-70	63	126	124
1970-71	69	132	132
1971-72	85	164	137
1972-73	92	183	138

Dairy beef production was undertaken to a limited extent on dairy farms during this period but there is no evidence that more beef stock were run on South Auckland than Northland farms.

Despite about twice as much being spent per hectare on South Auckland as compared with Northland farms, no greater progress was made in increasing stocking rates or production. While limit-

ed expenditure would have affected the rate of progress on Northland farms, it should have had a much smaller influence in South Auckland.

The results in South Auckland could indicate that near maximum production had been reached, that a certain intensity of farming had been settled for, or that factors other than income had a dominating influence on production.

EFFECT OF OTHER FACTORS

Other factors which probably affected livestock numbers and, more particularly, per-head performance were dry seasons, depredations by insects, and managerial inexperience.

Rainfall

In Table 8 rainfall in January to March inclusive is compared with the average for the 30-year period 1941-1970 at 11 centres (N.Z. Meteorological Service, 1960-70). The greater-than-normal number of dry seasons in the period 1968-74 is apparent.

TABLE 8: YEARS WITH ABOVE-AVERAGE RAINFALL

	1960-67	1968-74	1975-76
Kaitaia	4	2	1
Ruakura	6	2	2
Palmerston North	6	2	1
Waipukurau	3	2	2
New Plymouth	5	3	1
Nelson	7	1	2
Christchurch	4	2	1
Waimate	3	1	1
Taieri	4	2	0
Alexandra	5	2	0
Invercargill	5	4	0

At No. 2 Dairy, Ruakura, which was at the same stocking rate and under unchanged management over the period, there was a significant correlation of 0.82 between yearly per-cow production and total rainfall in January, February and March in the years from 1968-9 to 1975-6, indicating that dry summers had a major influence on per-cow output.

As the yearly production pattern at Ruakura was very similar to the national average it is probable that national per-cow performance was similarly affected. Dry summers probably also influenced lambing percentages, wool weights and sheep slaughter weights.

Low levels of nutrition in one season also have a carry-over effect on performance in following seasons. For example, in North Island tested herds, poor summer-autumn production is followed by lower production the following spring, probably because autumn feed supplies are depleted and cows are in light condition. Conversely, when autumn production has been high, good spring production, as in 1976, usually follows. A similar relationship is likely to obtain in sheep production.

The considerable improvements in average wool weights, lambing percentages, and production per cow following generally good climatic seasons in 1975 and 1976 support the view that production per animal was severely depressed by dry seasons from 1968 to 1974.

Insect Pests

Although no insect-population data are available, entomologists are convinced that from the mid-1960s soldier fly and black beetle have spread in the northern half of the North Island and grass grub and porina are much more widespread, especially since DDT was banned in 1970 (R. P. Pottinger, pers. comm.).

Managerial Inexperience

The inexperience of many farmers in coping with high stocking rates under conditions where pasture improvement was not continuing, and when adverse seasons were common, probably also contributed to the decline in per-head output.

COMBINATION OF EVENTS

With the benefit of hindsight, the difficulty of increasing livestock production in the late 1960s and early 1970s because of the combination and sequence of events can be appreciated. Apart from relatively minor seasonal depressions, livestock numbers and production had increased steadily since the war owing mainly to continued land development, improvement of pastures and, in the early 1960s, good seasons. From 1967 development largely ceased although livestock numbers were still increased for a couple of years. Droughts were quite widespread over the period 1968-1970, reducing per-animal performance appreciably. At the same time, product prices were low, resulting in a fall in net incomes in real terms. There were also considerable marketing uncertainties at that time.

While most districts experienced more normal seasons in 1971 and 1972, prices were still depressed and most farmers were probably more interested in stabilization than expansion. There were major improvements in product prices in 1973 and 1974 and land development and pasture improvement work was resumed but droughts were again very widespread, resulting in a further fall in per-head performance.

With such a combination and sequence of events, it is not really surprising that livestock numbers on developing farms have not been increased before now. There have, however, been many instances where individuals have increased production in this period and there were no good reasons why this should not have been so on previously under-farmed and under-managed properties or where capital was available on partly developed farms.

The events, and for farmers traumatic results, have of course been embarrassing to technical advisers and, I think, have placed them in a defensive position. Advisers advocated increased stocking rates and in many cases increased borrowing in the 1960s. The final result was lower net incomes. However, in my view this advice was sound as no one could reasonably have forecasted future market prices or the sequence of poor seasons. If farmers had not increased numbers they would have been even worse off. There does appear, however, to be an unfortunate reaction by many farmers and advisers to higher stocking rates and this may hinder future production.

CHANGES IN LAND USAGE

A further factor which has affected livestock numbers in recent years is changes in land usage. The most important of these are summarized below.

Small Holdings

These are mainly described as 4 ha lots, although many are larger. In the area around Hamilton city, 80% of these have been surveyed off since 1968 (M.O.W.D., Hamilton, pers. comm.) and this was probably the pattern in other parts of the country. Prior to 1970, then, most of the small holdings were in large units, the livestock on which were included in national surveys, but since subdivision and sale it appears that they have not been surveyed. In the Farm Production Statistics for 1974 (Department of Statistics, 1974), there were 7420 holdings of 9 ha or less occupying a total area of approximately 35 000 ha. A Minis-

try of Works national survey (Town and Country Planning Division, M.O.W.D., 1974), however, indicates there are about 27 000 such holdings on 104 000 ha of land, so it is probable that the livestock on about 70 000 ha have not been accounted for.

Crops

The area in market garden and processing crops, fruit trees, berryfruits and vines has increased steadily in recent years, although that in hops and tobacco has been reasonably static or has declined. Overall the area in these crops increased from 25 000 ha in 1967 to 36 500 in 1974 (Horticulture Statistics, MAF, 1975) and in fact a larger area has been lost to grazing because on market gardens the land actually cropped represents about 50% of the total land held. Land in export crops, however, yields a very much higher monetary return than from livestock, with exports worth \$35m in 1975-6.

The total area in the farm cash crops — wheat, barley, oats, maize, peas, potatoes and onions — although varying from year to year, has trended upwards with 225 000 ha being grown in 1975 compared with 162 000 in 1967. Some grazing, of course, is possible on such land.

Forests

The area planted in exotic forests has increased dramatically in the last decade. In 1967 there were 489 000 ha in trees and by 1975 this had increased to 692 000 ha (N.Z. Forest Service, 1975). Of these totals, 248 000 and 362 000 ha, respectively, were owned by the State. Some of the land used for planting by private individuals and commercial companies had previously grazed livestock, although the exact area is not known.

Horses

Other livestock, particularly thoroughbred racehorses and to a lesser extent trotters and pacers, have supplanted cattle and sheep on many highly productive farms although the number of station hacks may have declined. The total number of active and retired racing horses is not known but the numbers of thoroughbred brood mares at stud were 5358, 5713 and 9201 in 1959, 1968 and 1975, respectively, and there were corresponding increases in the numbers of foals born each year — 1352 (1960), 2169 (1968), and 4236 (1975) (N.Z. Racing Conference). In addition, the number of Junior and Associate riders in pony clubs

increased from 6717 in 1967 to 10 185 in 1976 (Secretary N.Z. Pony Clubs Association, pers. comm.).

An estimate of the number of thoroughbred horses can be made from a knowledge of the number of foals born and the number sold overseas based on an average length of life. For horses living on average for 12 years, the populations in 1967 and 1975 would be about 17 500 and 30 000, respectively. In addition to these there may be about 20 000 trotters, pacers and pleasure horses.

Although these animals have displaced cattle and sheep, we should not begrudge them their grazing, for about \$10 million of overseas exchange was earned in sales and stake winnings in 1974, an average of about \$200 per horse (similar to the earnings of a dairy cow). Within New Zealand, too, they contribute a significant sum to tax receipts, even though the method of collection is somewhat cumbersome and expensive.

Towns

With a growing population, the area in cities, boroughs and communities increased from 277 000 ha in 1967 to 360 000 ha in 1975 (*N.Z. Official Yearbook*).

Total Effect

An estimate of the total effect of these changes in land use is given in Table 9. Similar changes occurred in earlier periods but they were of lesser magnitude.

The land used for towns, crops and horses is amongst the most productive in the country and the livestock displaced or replaced were probably run at about 15 stock units/ha.

TABLE 9: LAND USE AND EFFECT ON LIVESTOCK NUMBERS

	1960	1967	1974 or 1975	Effect on Livestock Numbers 1967-74 period (m stock units)
Farm cash crops (000 ha)	128	162	255	1.3
Horticultural and processing crops (000 ha)	17	26	36	0.2
Area in towns (000 ha)	177	277	360	1.5
Farm forests (000 ha)	427	489	692	0.8
Small subdivisions				1.0
Racing and pleasure horses	28 000	50 000		0.2

The influence of forestry is not clear as there are no data on the extent of planting in previously grazed and non-grazed areas.

Overall, these changes have had a relatively small but significant effect on the livestock population.

A number of other factors have been suggested as having affected livestock production. Amongst these are increases in average farm, flock and herd sizes. While these may have had an influence, similar changes took place during the expansion phase of the early 1960s.

PRESENT AND FUTURE

Throughout the 1950s and 1960s the rate of increase in livestock numbers averaged about 2 million stock units per year. Even with good economic conditions this rate of increase would have been difficult to sustain from 1968 onwards, but had land development and pasture improvement continued the number of stock units could by now be about 10 million higher. The total cost of developing the necessary 0.5 million ha of land and initial topdressing of a further 2 million ha would have been about \$100-150 million at prices ruling in the late 1960s and early 1970s (Rikys and Glenday, 1968). In retrospect, this would have been a good investment as today's annual returns from an extra 10 million stock would be in excess of \$200 million.

Because production has been relatively static while domestic consumption has increased, pastoral products have declined in importance in terms of the amount of exports available per head of population. This is illustrated in a simple measure, the number of stock units per head of population, in Table 10. Included in the table are the numbers of stock units required in 1986 and 1991 at forecasted populations to maintain the 1975 ratio.

TABLE 10: STOCK UNITS PER HEAD OF POPULATION

	<i>Stock Units</i>	<i>Population</i>	<i>Stock Units/head</i>
	(m)	(m)	
1970	...	2.82	35.7
1975	...	3.11	32.1
1986	...	3.77	32.1
1991	...	4.13	32.1

The consequences of not achieving increases of the order shown are illustrated in Table 11. If production were to remain at the 1976 level and current domestic consumption was maintained (100 kg meat, 4.5 kg wool, 23 kg milkfat per head), both the amount available for export and particularly the amount available per head of population would fall.

TABLE 11: EFFECT OF STATIC PRODUCTION ON ANIMAL PRODUCTS AVAILABLE FOR EXPORT

		1976	1986	1991
Total production:				
Meat (000 t)	....	1200		
Wool (m kg)	....	312		
Milkfat (000 t)	....	302		
Produce available for export per head of population:				
Meat (kg)	....	273	218	190
Wool (kg)	....	96	78	71
Milkfat (kg)	....	73	57	50

These data illustrate the necessity for increasing animal production or its equivalent in crops or trees to have a reasonable opportunity of maintaining current export income standards.

POSSIBILITY OF ACHIEVING TARGETS

The target of 121 million stock units for 1986 is almost identical with that suggested as being attainable by Farm Advisory Officers in the State of the Livestock Industry report.

There are reasons for believing the target will be difficult to achieve. The average increase required of 2 million stock units/year is about the same as that attained in the 1950-1970 period and it now has to be obtained by farmers who are said to lack confidence — from better developed land, and in the face of increased competition for land from other sources. By 1986, for instance, the loss of land to towns may amount to another 100 000 to 150 000 ha; a further 50 000 ha or so will probably be required for farm cash crops (grains, potatoes, onions and peas) and an extra 10 000 ha for horticultural crops just to meet increased local demand, and increased plantings of all crops are likely if export prices result in competitive returns. Increased forestry plantings are likely and racehorse numbers will probably increase whether profitability is maintained or not. Deer farming has favourable prospects.

Thus by 1986 about 250 000 ha of highly productive land at present running about 5 million stock units will be in some other form of usage and the extra 20 million stock units will have to be farmed on the remainder. If present trends continue, a further 250 000 ha of unimproved or marginal country will be used for forests.

On the other hand, there are considerable grounds for expecting that the target will be met. First, such an increase is readily attainable. In most districts average production is probably only 50 to 70% of that achieved on the highest producing farms. For instance, average South Auckland dairy farm production in the years 1969-70 to 1972-3 at 272 kg milkfat/ha of effective land (N.Z. Dairy Board Survey, 1975) was only 57% of that achieved (474 kg/ha) on the prize-winning ICI Farms of the Year (N.Z. National Fieldays Society, pers. comm.), over the same period, and this level of 272 kg may be well above average as the surveyed farmers produced 15 to 20% more milkfat per farm than suppliers of the N.Z. Co-operative Dairy Company.

Secondly, farmers may not lack confidence. This ill-defined term has been used widely in a political sense, and while there is no doubt that every farmer is concerned about such matters as low incomes and industrial stoppages, I can find no evidence that they have engaged in a deliberate policy of retrenchment. When incomes improved from 1972-74, capital investment (as described by farmers) on both sheep and dairy farms increased considerably (Table 12, Department of Statistics). In this connection the increase in topdressing has already been referred to.

Borrowing from the Rural Banking Corporation for development purposes declined considerably after 1966-7 but increased

TABLE 12: CAPITAL INVESTMENT ON FARMS

						Total Capital Investment (\$m)
1966	....	....	....	....	....	137
1967	....	....	....	....	....	124
1968	....	....	....	....	....	106
1969	....	....	....	....	....	100
1970	....	....	....	....	....	102
1971	....	....	....	....	....	114
1972	....	....	....	....	....	131
1973	....	....	....	....	....	186
1974	....	....	....	....	....	211

steadily in recent years with \$12.3m (1137 applicants), \$25.3m (2257 applicants) and \$34.7m (2863 applicants) being borrowed in 1973-4, 1974-5 and 1975-6, respectively (Rural Banking and Finance Corporation Annual Reports, 1967-76).

With regard to labour there is no evidence from census returns or farm surveys that the number of sheep and dairy farm employees declined in the period 1970-1 to 1973-4, the last year for which figures are available. Indeed, on sheep farms it appears there was a small increase in the number employed in 1972-3 and 1973-4 (N.Z. Meat and Wool Boards' Economic Service, 1975; Department of Statistics).

Thirdly, much of the preliminary improvement work has already been undertaken. In 1973 and 1974 large new areas were topdressed and it appeared that about 0.4 million ha of additional land was developed and sown to pasture (Table 4). Little benefit in terms of additional stock has as yet been obtained from these improvements.

Fourthly, most districts have had two good seasons and the current year is embarrassingly abundant for many farmers.

Fifthly, very good returns, generally favouring retention of livestock, are being obtained, and, sixthly, the Livestock Incentive Scheme, which may not have been necessary, offers a very attractive monetary reward for those willing to intensify.

For these reasons there could be a major expansion in livestock production. Numbers could increase by about 10 million stock units in as little as three years unless very poor seasons are again experienced. Getting the other 10 million may, however, require additional effort.

Further Land Development

Scope still exists for further land development. The area of land under the control of farmers and available for development to improved pasture is not accurately known but it seems that there are 0.8 to 1.4 million ha of land in phormium, rushes and secondary growth. No information is available as to how much is worth developing but it seems likely that at least 0.5 million ha could be profitably developed.

In addition, there are just under 5 million ha in tussock and native pastures — much of it in the high country of the South Island. While stock numbers on runs there have increased and performance has improved, there is still considerable scope for development. A survey of 73 runs in the MacKenzie and Omarama districts (Anon., 1973) showed that only 7.4% of the

area was classed as improved. The average stocking rate was approximately 0.6 stock units/ha. This contrasts with performance at Tara Hills where stock numbers increased sevenfold from 1950 to 1972 at which time the stocking rate was about 2.2 stock units/ha.

The development and improvement of both types of country to realistic present potential could result in a further 10 million stock units being run.

Adequate Facilities and Incomes

The greater opportunity, however, for achieving the desired increases in production is from the intensification of farming on existing partly and, by today's standards, fully developed land. The scope for doing this has been referred to. The next one or two years should tell whether farmers in general will respond or whether in fact their attitude to increasing production, or their ability to do so, has changed.

Experiences in the last decade fully support the claim that for production increases to be possible facilities and incomes must be adequate. Obviously extra stock cannot be run on farms if slaughter disposal is grossly disrupted through lack of facilities or stoppages.

Incomes must also be sufficient for growth to continue. The price-smoothing schemes for meat and wool may ensure that incomes do not fall to the 1974-5 levels which did not permit the most efficient farmers on a lot of North Island hill country to even maintain their properties, but the mere fact of having a minimum price will not necessarily permit growth to be achieved. Dairy farmers had a guaranteed price throughout the late 1960s and early 1970s but even with additional assistance by way of suspensory loans, dairy beef incentive payments and various subsidies, it was too low to provide incomes sufficient to continue development.

In my view the Livestock Incentive Scheme is very appropriate for present circumstances — providing a worthwhile incentive for those willing to undertake development work of a type which has a very high chance of yielding beneficial results. It has been criticized as being of no use to farmers already fully stocked, yet these are in the minority. As has been pointed out in the Task Force report (Holmes, 1976) and elsewhere (Ross, 1976), other incentives may be necessary for those farming at moderate levels of intensity.

It should be recognized, though, that intensive production already offers good profit incentives.

Technical Leadership

Following their experiences in the last 10 years and in view of dual-economy and inflationary developments, many farmers are undoubtedly more cautious now in regard to increasing production than in the 1960s. Technical advisers have a more difficult task in encouraging them to do so. It seems that clearer evidence of economic benefit without an increased workload will be necessary.

One important experience of the period of stagnation is that production on farms which had reached a high level of development and output by the late 1960s continued up and down about that level in much the same way as on farms at a much lower level of performance. This should encourage rapid development when the opportunity occurs, particularly as maintenance can be deferred without serious penalty when incomes recede. The work requirement on developed properties is also less and I am often impressed by the time for relaxation available to people on high producing farms.

An unfortunate experience was that the rapid increase in stocking rates was followed by a decrease in production per head; explanations for this have been outlined. Some farmers also had the experience of achieving greater total output from fewer stock in subsequent years, suggesting that lower stocking rates are preferable. While a proportion of farms probably were overstocked for the conditions which eventuated, the interpretation of between-year performance results in this way can be seriously questioned. The result has been a reaction against higher stocking rates by some farmers and advisers and this is unfortunate in that the desired production increases will not be obtained if average stocking rates are not increased further.

The experimental evidence on the subject is quite clear; higher stocking rates invariably result in greater total production. In 16 dairying comparisons, production per hectare was greater at the high than the low rate of stocking on 15 occasions and equal on the remaining one (Scott and Smeaton, 1975).

In four long-term studies with sheep (Joyce, 1971; Monteath, 1972; Joyce *et al.*, 1976; Kelly, 1976) both wool and lamb carcass production/ha increased with increasing stocking rates (with one exception for lamb output at an intermediate stocking rate). In 11 studies with fattening cattle (Scott, 1977, unpublished)

the highest stocking rate gave highest net meat production/ha in eight experiments, equal highest in two and lower in one. It is also clear that profits were lower at some of the highest stocking rates tested, but these rates were generally much higher than those employed in practice.

In commercial farming there can be a number of legitimate reasons for preferring lower stocking rates than a farm is capable of, but here, too, high stocking rates are desirable from a profit point of view (Table 13, N.Z. Dairy Board, 1975; Table 14, N.Z. Dairy Board, 1975; N.Z. National Fieldays Society, pers. comm.).

TABLE 13: STOCKING RATE AND NET FARM INCOME, 1972-5

<i>Stocking Rate (cows/100 ha)</i>	<i>Net Farm Income (\$)</i>				
< 50	4 976
50-99	6 545
100-149	7 825
150-199	8 698
200-249	8 930
250 +	10 051

TABLE 14: STOCKING RATES, PRODUCTION PER COW AND CASH SURPLUS, SOUTH AUCKLAND AVERAGE AND ICI FARM OF YEAR WINNERS

	1969-70	1970-1	1971-2	1972-3	1973-4	1974-5
Stocking rate (cows/100 ha):						
South Auckland	217	213	214	215	213	211
ICI	321	325	302	361	276	352
Production/cow (kg MF):						
South Auckland	118	122	134	132	124	137
ICI	123	137	164	170	176	148
Cash surplus/ha (\$)*:						
South Auckland	146	150	211	244	246	265
ICI	293	358	490	514	577	553

*Excludes interest, depreciation and labour costs.

The performance of the winners of the ICI contest indicate that higher stocking need not result in reduced per-cow performance. While the ICI farms were all highly developed, of good contour and in favourable climatic positions, the differences illustrate the scope for increasing stocking rates and monetary returns.

On some classes of sheep farms, too, average stocking rates are at relatively low levels. For instance, the stocking rate of 12.9 stock units/effective ha on intensive North Island fattening farms (N.Z. Meat and Wool Boards' Economic Service, 1975) is lower than the minimum rate used in stocking rate comparisons at Ruakura or Invermay even when allowance is made for some cash cropping on the survey farms.

While farming at a low to moderate stocking rate is preferred by many people and, if prosecuted properly so that high per-head performance is obtained, is productive and profitable, because of under-utilization of pasture it is generally a more wasteful system and is less well suited to obtaining full benefit from developmental expenditure.

Lead from Research

Further developments from the many disciplines of research will be important in making the task of increasing production easier and in setting new goals of performance. Reducing the effects of drought is a most important subject requiring further long-term study. In the past the levels of performance achieved at such centres as Te Awa, No. 2 Dairy, Ashley Dene, Winchmore and Invermay demonstrated attainable targets greatly in excess of average production. Since then further research has provided a greater understanding of important production processes making the attainment of high level performance more predictable and controllable. A reasonably large number of farmers have followed these leads and are producing at comparable levels but are not clear as to where to go next.

Much more investigation of complete production systems, involving home-grown crops and purchased fodders, is urgently required to see whether it is economically viable to run more than about 20 to 24 ewes/ha or produce in excess of 600 kg of milkfat/ha, about the current maximum levels from traditional grassland farming on lowland country. The requirement is even greater for hill country which has not really had a pace-setter since Suckling ran 15 ewes/ha at Te Awa. Such information is not needed so much for meeting short-term targets but the much more difficult ones which lie ahead.

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