Calf to Cups
– Rearing heifers from weaning to calving

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Introduction

From the moment you artificially inseminate a cow you are investing in obtaining a replacement animal for your herd. The cost of obtaining a pregnant 2 year old replacement animal by breeding and rearing it yourself is estimated to be around $1000-1200 (see Appendix 1). Buying an equivalent animal would currently cost $2000.

As with any investment you expect a return. The return on investment will not be realised if the heifer:

a) Fails to calve as a rising 2 year old (dies, fails to get pregnant, or aborts)
b) Dies or has to be dried off at calving
c) Does not produce well in her first season
d) Fails to get in calf as a rising 3 year old and has to be culled or carried over.

MacMillan (1973) found that only 81% of heifers tagged at birth actually calved as two year olds, while a further 14% were culled before calving as three year olds. Miranda Barnes from the Taranaki Agricultural Research Station looked at losses within that herd from birth to second calving over the 10 year period 1979-1989. 1% were lost at birth, 4% by weaning, 11% by first calving, 22% by second calving.

I was unable to find more recent statistics but I doubt that with an increase in average herd size that heifer performance will have improved. Lower wastage rates than these would result in a better financial outcome for a dairy farming business, but rearing good replacement stock can be incredibly rewarding without considering the financial incentives.

How does your heifer rearing stack up?

These key performance indicators can tell you whether your heifer rearing and the introduction of heifers into the herd are being managed adequately.

Empty rate

Several commercial grazing companies have kept good records of empty rates in large numbers of heifers. This provides us with robust NZ data about achievable reproductive performance in rising 2 year old animals.

Table [1]**:** New Zealand Grazing Company- Heifer Pregnancy Rates 1995 and 1996

	Friesian (3473 animals)	Jersey (1355 animals)	Roan Cross (946 animals)	Cross-bred (1044 animals)
Pregnant	96.1%	94.8%	96.2%	96.1%
Aborted	1.8%	2%	2.9%	2.6%
Calved	94.2%	93.7%	92.5%	92.4%

Table [2]**:** Vetcare Grazing Wanganui 1994-2006 – Heifer Empty rates

	Friesian and Xbred (17,155 animals)	Jersey (10,018 animals)	All breeds (27,173 animals)
Empty	4.8%	7.6%	5.8%

"Whatalotta heifers" (Taranaki) reared 7,000 heifers over 7 years (1994-2001). Over all breeds the average empty rate was 4.52% with a range of 3.69-5.35% (Dairy Exporter, Aug 2001).

Calving rate

Calving rate of heifers is just as important as empty rate. Calving early within the calving pattern of the herd is important for heifers so they have more days in milk and can achieve good production levels in the first lactation. It also allows them more time to cycle post calving, optimising the chance that they will calve again as 3 year olds.

Ideally 75% of their heifers should have calved by week three of calving and 92% of heifers calved by week 6 of calving. (InCalf, DairyNZ)

If less than 65% of heifers have calved by week 3 and less than 85% of heifers have calved by week 6 of calving then there is a problem. (InCalf, DairyNZ)

Production in first lactation

Well reared heifers should produce 80-85% of the milk solids produced by their adult herd mates (Pickering 2001).

3 week submission rate of first calvers

90% of first calvers should have been submitted by week 3 of AB in the mating season after they calve.

If less than 81% of first calvers are submitted by week 3 of AB then there is a problem. (InCalf, DairyNZ)

Death rate

Whatalotta Heifers (Taranaki) reported an average annual death rate of 0.6% grazing heifers May-May in the years 1994-2001 (Dairy Exporter, Aug 2001). The NZ Grazing Company figures involving 25,000 heifers in 1995 showed a death rate of 1%.

Why might heifers not meet these targets?

The most obvious reason is that they have not been well enough grown. Poorly grown animals are more likely to succumb to disease and die, are less likely to get in calf and don't produce as well. If you don't believe that line of thought, don't bother reading any further. The following notes outline studies that prove why heifers need to reach target weights at the crucial times in their lives. Obstacles to achieving these live weight targets are also discussed.

Liveweight targets

Table [3]**:** Target heifer liveweights – InCalf book (Dairy NZ)

Age of heifer	Mature Cow Liveweight	400kg	450kg	500kg	550 kg	600kg
	Liveweight BV	-78	-28	+22	+72	+122
3 months		70	80	90	100	110
6 months (30% of mature lwt)		**120**	**135**	**150**	**165**	**180**
9 months		160	180	200	220	240
12 months		200	225	250	275	300
15 months (60% of mature lwt)		**240**	**270**	**300**	**330**	**360**
18 months		290	330	365	400	440
22 months (90% of mature lwt)		**360**	**405**	**450**	**495**	**540**

Mature body weight varies with the breed and line of cattle. It is often under estimated. The InCalf programme suggests weighing a group of mature (5-6 year old) cows from your herd in April May to get an accurate assessment of mature bodyweight for your herd. Alternatively it can be estimated using the Live weight Breeding Value (Lwt BV), as in the above table.

Live weight at mating (15 months)

These targets have been established because the onset of puberty is live weight rather than age dependant. Heifers will cycle when they reach 43% of their mature body weight (McNaughton et al 2002). To have 90% of heifers cycling and able to conceive at the beginning of the mating period they need to be at target weights.

Live weight at mating (as a rising 2 year old) appeared to have an effect on submission rate as a rising 3 year old in the herd. (Hayes 1999)

Table [4]**:** Effect of mating weight as a heifer on submission rate as a milking R3 year old

Class	21d submission rate
MW1 = mating weight 1 = more than 1 standard deviation below the mean weight of the group	93.2%
MW2 = mating weight 2 = below but within 1 standard deviation Of the mean weight of the group	95.3%
MW3 = mating weight 3 = above but within 1 standard deviation Of the mean weight of the group	96%
MW4 = mating weight 4 = more than 1 standard deviation above The mean weight of the group	94.8%

The MW4 group (heaviest animals) had a slightly lower submission rate than the MW3 group. Perhaps this is because well conditioned heifers are more likely to burn body fat and develop ketosis. One of the main reasons for not cycling post calving is excessive body condition score loss. (InCalf, DairyNZ)

It was shown in a New Zealand study (van der Waaij et al, 1997) that for each additional kg of weight at 15 months of age, the first lactation response was 6L of milk, 0.18kg protein and 0.25kg fat. This equates to $3/kg bodyweight, or $60 for every 20kg of extra bodyweight at mating (up to targets).

Live weight at calving

(a) Production in first season

By increasing live weight at first calving in Australian Friesian heifers, a number of authors (Cowan 1974, Dobos 1999, Freeman 1993) have shown that milk yield increases by 8.7, 4.1, and 4.4L per extra kg of liveweight in the first lactation. Cowan and Freeman also reported that by the end of the third lactation the total response was 23L and 21L respectively in each of their studies.

Penno NZ, (1997) found that the response to an extra kg of live weight at first calving was 0.12kg MS.

By having heifers 50kg heavier at calving (up to target levels) in a $7 payout you could expect to make $140-280 more per heifer in their first year of life.

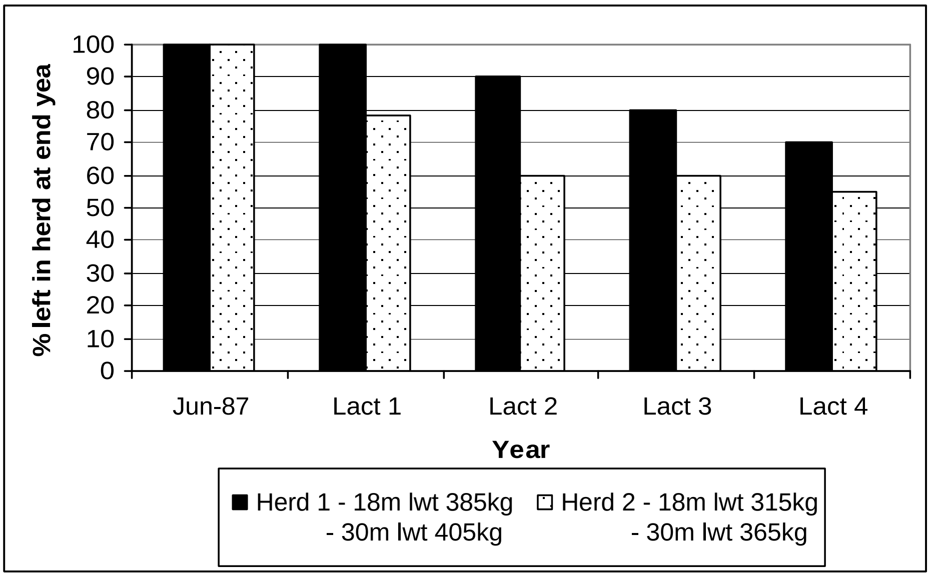
Table [4]**:** Production comparison for heifers between years with different graziers and pre-calving liveweights - Vetcare Grazing

Year	Grazier	Average weight May 1st	Production compared to rest of herd in Aug	Production compared to rest of herd in Oct
1999	Private	480kg	77%	76%
2000	Vetcare Grazing	525kg	86%	85%

(b) Survival rate

The following figure compares the survival rates of heifers through to their 4th lactation for two different herds with different live weights pre calving

Figure [1]**:** Percentage of heifers surviving to 4th lactation (Bryant and McRobbie 1991)



Growth rates

To achieve target live weights at mating and calving, Crossbred animals need to grow at 0.6kg/day, Friesians at 0.75kg/day, and Jerseys at 0.54kg/day. (DPS course notes)

In John Penno's study (1997) the level of feeding from 90-200kg live weight had no effect on subsequent milk fat or protein yield. However heifers offered a high level of feeding after 200kg (0.7kg/day lwt gain) produced 9.6kg more milk fat and 6.6kg more protein in their first lactation that heifers offered a low feeding regime (0.5kg/day lwt gain).

John Pickering from Vetcare grazing Wanganui recorded a dramatic drop in conception rates in heifers if feed intake suddenly declined after mating. (Dairy Exporter Aug 2001)

Table [5]**:** Effect of feeding level pre and post mating on conception rates – Vetcare grazing

	High Pre – Low post	High Pre- High Post	Low Pre – High Post	Low Pre- Low Post
First service conception rate	38%	65%	71%	70%

Table [6]**:** The effect of mating live weight and growth rate at mating on conception rates in Friesian heifers in Western Australia (Hough 1993)

Mating live weight	Conception rate to first service (%)
< 340kg	55
340-355kg	59
356-370kg	70
>370kg	72
Losing weight at mating	58
Maintaining or gaining weight	72

Compensatory growth

This phenomenon has been touted for years but the truth is that animals that are weaned at low weights never catch up even at maximum growth rates.

Table [7]**:** Overs and Unders – John Wells. Dairy Exporter May 1995. (494 Friesian heifers)

Classification group at start of grazing	Actual weight	Finish weight	Weight gain	% of start weight
Average	216kg	423kg	207kg	196%
Overs More than 15kg above average	238kg	452kg	214kg	190%
Unders More than 15kg below average	190kg	392kg	202kg	206%

The main determinants of weaning weight are colostrum intake at birth, feeding and disease incidence prior to weaning. Calves with low antibody levels in the blood (poor colostrum uptake/intake) had lower growth rates and higher mortality rates than calves with better antibody levels.

Table [8]**:** Effect of colostrum intake on pre weaning mortality and growth rates (IJ Lean 1992)

Blood level of antibodies (mg/dl)	Weight gain in first 30d	Mortality rate
<5	0.75kg	30.8%
5-6.5	Not reported	16.3%
>6.5	5kg	0

Measuring growth rates

Visual estimation of the weight of growing heifers is unreliable. Heifers can look well conditioned and shiny and appear to be blooming without actually growing at all. Weigh bands are better than nothing. Research shows that on young stock they are accurate to within 10% of the actual weight of the animal but accuracy decreases in older animals and varies greatly with gut fill. Ideally heifers should be weighed every month or bi-monthly.

Obstacles to achieving heifer rearing targets

Rumen development

When a calf is born it digests a diet of milk in its fourth stomach (abomasum). Eventually the diet of the calf will be grass which is broken down by bacterial fermentation in the rumen. Poor rumen development from birth to weaning can cause a weaning check and affect growth rates for months post weaning.

The key to *developing rumen size and muscle* is to feed bulky fibrous feeds, eg hay and straw. The key to *developing the rumen lining* is to feed concentrates (meal/cereals) which have high levels of readily digestible sugars. The products of sugar fermentation stimulate the development of small finger like projections called papillae. These increase the surface area of the rumen and allow for the efficient absorption of nutrients. It is necessary to feed both kinds of feed, not one or the other.

Figure [2]**:** Photos of rumen development at 12 weeks on different diets (Penn State University)

Calf fed milk and hay   Calf fed milk, hay and concentrates

Feed quality

Heifer replacements should be offered quality feed at all times. This year's very dry summer has seen our clinic called to unprecedented numbers mobs of rising 1 year old cattle experiencing health problems. Body muscle growth requires high protein levels in the diet. Mature seedy pastures do not provide these protein levels. The growth rates outlined above are only achievable on ad lib intake of green leafy pasture.

Production limiting diseases

Scouring animals have not always got worms! Parasitism, BVD, Coccidiosis, Yersiniosis and Salmonellosis may be difficult to differentiate without blood and faecal testing. If the appearance of the animals doesn't pick up significantly with a drench, further investigation should be carried out. Weighing and monitoring weight gains will really tell you whether they are over the problem or not. Often wishful thinking has you convinced they are "picking up" but are they actually achieving target weight gains?

i) BVD (Bovine Viral Diarrhoea)

BVD is not just a disease that vets have thought up to make more money. This is the comment I have heard from several farmers. BVD causes ill thrift, immuno-suppression, mild diarrhoea and poor growth rates in weaned calves. It also causes reproductive problems in animals that are infected for the first time while they are pregnant.

It is very common. Current estimates are that 90% of dairy herds have sero-positive animals in them (Reichel, 2008). These animals have antibodies to the disease and have been in contact with the virus at some stage in their life. 15-17% of herds are estimated to be actively infected and contain carrier animals. This rate could be higher in the South Island where herds are larger have been made up from many different sources.

The calves look like they have worms. And they probably have got worms because the immuno-suppression present with BVD means they get most “childhood” diseases of calves worse than a mob of calves that isn’t infected with BVD. They can be coughing and have ringworm as well.

A mob of 5 month old animals that I dealt with recently were only growing at 0.5kg/day and approx 1 animal every couple of weeks was being injected for some kind of sickness. Two had died. After the first BVD vaccination the growth rate in the following month was at target of 0.7kg/day and the sick calves ceased occurring.

There is an often voiced theory that “it will pass through them all and they will all become immune before they are mated”. Studies have shown that under grazing conditions new infection rate may be as low as 1% per day (Horner, G 1996). This and waning of immunity means that there may always be a percentage of the mob susceptible to the virus. The loss in growth rate over the months that a mob of heifer calves is infected can be huge and may never be made up.

Talk to your vet about diagnosing BVD and the control options available. It is a complicated disease and a full discussion is not possible in this paper.

ii) Coccidiosis

This sub-clinical form of the disease is far more common than the classic clinical case of coccidiosis which presents with straining and blood in the faeces. Clinical cases (obvious scour) may be only 5% of the affected animals. Apart from mouth ulcers that are sometimes present with BVD, the two diseases may be indistinguishable without testing.

Coccidiosis is most likely to occur at or around weaning. Nearly all processed concentrate feeds available for calves contain some kind of coccidiostat (a chemical which controls infection with coccidia). Providing at least 1kg of meal/calf will ensure they receive the preventative dose of coccidiostat. This should be continued for at least 3 weeks after weaning. Calves that are actually experiencing coccidiosis would need a higher “treatment” dose of coccidiostat.

In one trial conducted at the Sierra Foothill and Research Institute in the USA cattle were weaned receiving (a) no coccidiostat, (b) Deccox (c) Bovatec. If they were receiving coccidiostat, they received it for 28 days after weaning. Clinical disease, faecal oocysts counts and weight gains were monitored. The two treatment groups grew at 0.5lb per day (0.22kg/day) more than the untreated animals despite only mild to moderate challenge of all groups with coccidia. (Maas, J 2008)

Rumensin trials (Watkins 1986) showed that when animals were challenged with coccidia, weight gains and feed intake were significantly better in the treated animals than in the control (not treated) animals.

Table [9]**:** Effect of rumensin on ruminating calves challenged with coccidia (Watkins 1986)

	Rumensin level in feed (g/tonne)			
	0	10	20	30
Average daily gain (lb/day)	1.31	1.59	1.94	1.96
Average daily dry matter intake (lb/day)	5.49	5.58	6.03	6.17

“Calf paddocks” can get a build up of coccidial oocysts because they persist for long periods of time in the environment. They are resistant to heat, cold and most disinfectants (NASIS website). Moving calves often reduces the risk of coccidiosis. Clean pasture that hasn’t had calves on it before is best. Moving meal feeders around the paddock prevents the muddy damp areas in which coccidial oocysts can sporulate and become infective

iii) Parasitism

Gastro-intestinal parasitism reduces voluntary feed intakes and efficiency of feed utilization. The reasons for the reduction of feed intake are not really understood.

Ingested and absorbed nutrients have to be used for repairing gut damage and mounting an immune response to the parasite rather than for growth. This reduces feed conversion efficiency (Coop 1993). Animals on diets with adequate protein (not stalky summer grass) are more able to cope with parasitism because they have the nutrients to repair the damage and become immune.

Immunity to parasites starts to develop at 6 months old. The animal starts to control

(a) the establishment rate of the larvae that are ingested,
(b) the development rate of the ingested larvae,
(c) the egg production of the worms which do establish (Armour & Ogbourne 1982).

This means that faecal egg counts in animals over 6 months of age can be unreliable. Animals can have significant burdens of adult worms but be suppressing their egg production so that the faecal egg count is low. This is marked different to the situation with sheep where FEC can be used to determine whether drenching is necessary.

The larvae that the animal eats but stops from developing can sit “inhibited” in the lining of the gut. Later in life, often at first calving, when the immune system of the cow is suppressed, these “inhibited” larvae can resume their development. Large numbers of them emerge and create damage at the same time. This is called Type II Ostertagiosis and can occur in heifers after their first calving leading to precipitous weight loss and profuse diarrhoea (Bisset 1995).

We have relied heavily on drenches to control worms in young stock. Scarily, parasites have become resistant to drenches. Mason and McKay (2006) selected 5 commercial dairy heifer rearing units that had animals with clinical signs that could be related to parasitism despite routine drenching. They found Cooperia worms that were resistant to ivermectin (Ivomec and many other generic products now) and eprinomectin (Eprinex) on all five farms. Ostertagia was possibly developing resistance to ivermectin but not eprinomectin. Trichostrongylus species were also shown to be developing resistance to ivermectin, eprinomectin and levamisole when used separately.

Combined use of levamisole and ivermectin pour-on were effective against all species of worms on all five farms. They commented that “to effectively manage roundworm parasites in their calves, farmers need to be aware of the resistance status of the parasites on their farms”.

Waghorn et all (2006) also reported drench resistance in a survey of 62 bull beef rearing operations in the North Island. These operations may be slightly more intensive than heifer rearing operations but probably do not differ by much. These farms were not experiencing problems. Only 7% of farms did not have at least one worm species that was showing resistance to one of the drench families. 92% of farms showed evidence of resistance to ivermectin, 76% of farms showed resistance to albendazole (white drench), 74% of farms had resistance to ivermectin and albendazole used together. Only 6% of farms showed resistance to levamisole (clear drench). Cooperia is the worm that appears to be the most difficult to kill but fortunately in this study there was no Cooperia that were resistant to levamisole so it appears we still have one drench family that is effective against it.

To reduce reliance on drench, grazing calf paddocks with holdovers or sheep can help to remove larvae from the pastures. Never grazing low in the pasture may help reduce larval intakes by stock. It is a fallacy that larvae are killed by frost. Their development is stopped but they will still be there next season to infect the next season's calves.

An interesting but very old study from Ballinger (1943) demonstrated the interaction between grazing strategies and worm burdens, and the effect they had on heifer growth.

Table [10]**:** Set stocking vs rotational grazing of calves with no drenching (Ballinger 1943)

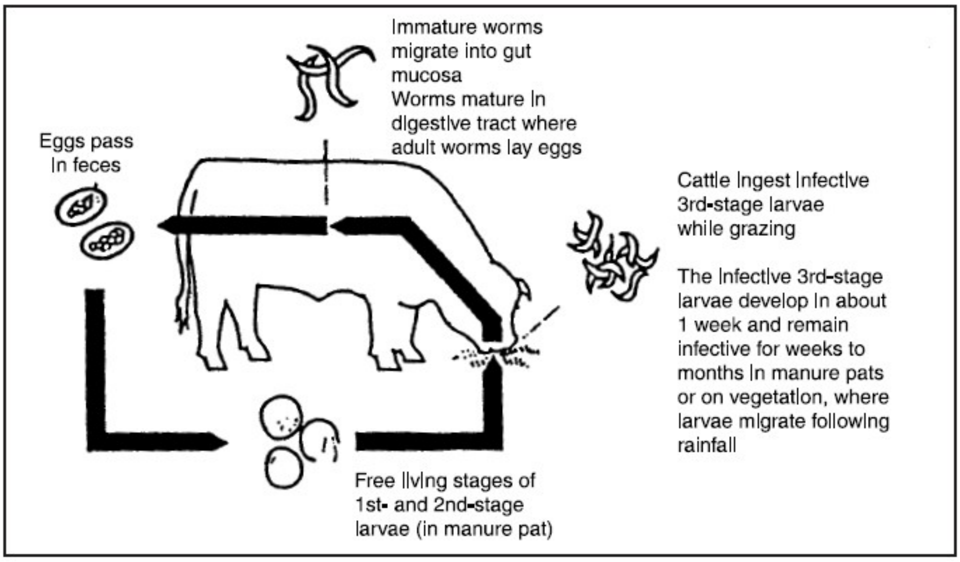
	Initial liveweight (lbs) Nov 1940	Final liveweight (lbs) April 1941	Liveweight gain (lbs)	Average FEC at end of trial
Set stocked	207.6	350.7	143.1	802 epg
Rotationally grazed	210.8	439.4	228.6	46 epg

Table [11]**:** Set stocking vs rotational grazing of calves with drenching of some set stocked calves with phenothiazine once a month (Ballinger 1943)

	Intial liveweight (lbs) Jan 1942	Final liveweight (lbs) April 1942	Liveweight gain (lbs)
Set-stocked undrenched	322.7	345.4	22.7
Set stocked drenched	317.4	362.4	45
Rotationally grazed undrenched	342.8	428.8	86

Even when drenched, the set stocked animals did not perform as well as the rotationally grazed animals. It was not just their worm burden in the first year of the study that was limiting their growth. Nutrition in a set stocked situation was limiting performance compared with rotational grazing. A further year of the study compared rotational grazing ahead of or behind the cows and as you would expect the calves grew better when allowed the best feed ahead of the cows.

Figure [3]**:** Life cycle of Strongyle worms.



iv) Yersiniosis/Salmonellosis

Both of these bacterial diseases are more likely to occur in stressed and immuno-deficient animals. Often the whole mob looks slightly diarrhoeic and may have concurrent BVD or coccidia infection. Some animals may die, but the growth rate suppression in the animals that live is just as significant as the deaths. Prevention is by good nutrition and husbandry and prevention of immuno-suppression by BVD vaccination and adequate trace element status. There is a vaccine to prevent Salmonellosis. Yersiniosis vaccine is available for deer but it is not able to be used in cattle. Sometimes to limit the deaths and minimise the period of poor growth a proportion of the mob will have to be treated with antibiotics.

v) Trace element deficiencies

Growing animals have requirements for copper, selenium and cobalt which can be as high in some cases as lactating animals. Supplementation requirements will vary with soil type and fertilizer regimes. Ideally supplementation should be based on animal testing because the relationship between soil and pasture levels and blood/animal levels can be complicated by interfering factors, especially in the case of copper.

vi) Clostridial diseases (5 in 1 diseases)

Can cause sporadic sudden deaths and are cheap to vaccinate against. This is very low cost insurance

vii) Facial Eczema

This is a big problem in the North Island but has never been confirmed to be a problem in the South Island. This is because grass minimum temperatures (even at night) have to remain above 14 degrees and humidity levels in the sward must also be high for at least 2-3 nights in a row for the fungus to sporulate (Parton 2001).

Bull management/mating management

Provided heifers are at target weights at mating (and are not free-martins!) 90% should be cycling and able to get in calf. The other main limiting factor to the heifers conceiving is the fertility of the bulls used to mate them.

Points to note about bull management in mobs of heifers

- Bulls should be a *suitable height and not too heavy* for the animals they are serving.
- Consideration should be given to the *calving difficulty* of the sire used. A heifer may never produce milk or calve again if she ends up paralysed or damaged from her first calving. Jersey bulls very rarely give calving difficulty.
- *Use 1 bull:30 heifers* even if the mob has been artificially inseminated. Usually AI'd mobs have been synchronised and the returns to oestrus will be synchronised as well. The extra bull power will be needed. Especially if yearling animals, with less sperm storage capacity are used.
- *Bulls should be BVD (Bovine Viral Diarrhoea) tested and vaccinated*.
  BVD infection can cause poor conception rates, embryonic loss and abortion in animals that are exposed to it for the first time while they are pregnant. There are two types of BVD blood test.

  BVD antigen testing is the most common type. If a bull is negative to this it means he is not a carrier of BVD. BVD carrier bulls can have low sperm counts and abnormal sperm but they also spread the disease to heifers and cause poor conception rates because she is infected with BVD while trying to conceive.

BVD antibody testing tests or antibodies (protection from previous exposure) to BVD. If a bull has no antibodies and is introduced to a mob of heifers in which BVD is sub-clinically cycling then he will become infected and transmit the virus to many heifers due to close contact that he will have with them. This situation is probably more common than introducing a carrier bull.

USING A NON-IMMUNE BULL IS AS PROBABLY AS BAD AS USING A CARRIER BULL. VACCINATE BULLS OR BLOOD TEST THEM TO ENSURE THEY HAVE IMMUNITY.

- Bull should be *free of TB (tuberculosis) and EBL (enzootic bovine leucosis)*
- About 20% of virgin bulls will be infertile or sub fertile, using lots of bulls can overcome this provided the culprit is not a dominant animal.
- *Watch the bulls working*. If you have any suspicions that a bull is not able to mate because of anatomical reasons or lameness then he should be retired and replaced.

Give consideration to *mating the heifers 10 days before the start of mating the herd*. Heifer on average take 10 days longer to cycle after calving than adult cows. By mating them earlier they are more likely to be cycling by the Planned Start of Mating for the herd. Usually there are some adult cows which calve a bit early that can help lead the heifers into the milking shed.

Farm environment and cattle handling skills

In New Zealand Grazing company statistics the annual death rate of grazed heifers was 1%. In 20% of cases the cause of death was not recorded. Disease (Facial Eczema, BVD, Blackleg, Gut infections) accounted for 50% of deaths. In 30% of deaths, physical injury was reported as the cause. Animals drowned, broke legs during yarding and trucking, received bulling/mating injuries, fell in tomos, down cliffs, and got tangled in fences. Good handling of cattle and premium facilities and fencing may minimise these losses.

Conclusions

Well reared heifers that reach target weights will get in calf quickly, compete, produce, and survive well within the main dairy herd. The obstacles to achieving target performance can be overcome by good feeding, monitoring and disease control.

Appendix 1: The cost of rearing a replacement heifer

$ per animal

AI of the cow (1.5 inseminations to achieve 1 pregnancy)……..………………..37.50

Cost of the calf shed (Poukawa Calf Rearing Newsletter) ……………………….…3.00 Bedding

for the calf shed (Poukawa Calf Rearing Newsletter...……………………. 5.00

Labour in the calf shed (1 labour unit/200 calves for 10 weeks @$600/wk)………30.00

Milk (Poukawa calf rearing survey 2004 showed dairy farmers on
average fed 313L of milk/calf – ½ of this saleable colostrum $1.70/L)………… 255.00

Meal (Poukawa calf rearing survery 2004 showed dairy farmers on
average fed 60kg meal/calf- last years meal price Sthld $560kg/tonne)……………33.00

Drench	mid Dec	120kg	
(pour-on)	End Jan	150kg	
	Mid March	170kg	
	End May	200kg	
	Premate Oct	305kg	
	Prewinter/calving	450kg……………………………………	13.50

Dehorning…………………………………………………………………………… 3.00

Grazing	mid Dec – 1 May (18wks @ $4.50)………………………………	81.00
	1 May – 1 May (52 wks @ $7.50)………………………………..	390.00
	1 May – mid July (10 wks @ $20)………………………………	200.00

Bull hire	$450/bull, 1 bull:30 heifers………………………………………..	15.00
Preg test…………………………………………………………………………		1.50
Vaccinations	Lepto twice in first year, once in second	
	5 in 1 disease, twice in first year …………………………………..	5.40

Trace element treatments

	10m old before first winter B12/Se/Cu injections…………………	1.40
	22m old before second winter B12/Se/Cu injection……………….	2.12

Ear tags ……………………………………………………………………………5.00

TOTAL COST OF REARING HEIFER REPLACEMENT $1261.00

Appendix 2: References

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