



**Livestock
Industries**

Crusader Meat Rabbit Project Which Breed and How to Use Different Breeds

SJ Eady and KC Prayaga

Which breed of rabbit is best? This is one of the first questions a rabbit farmer asks.

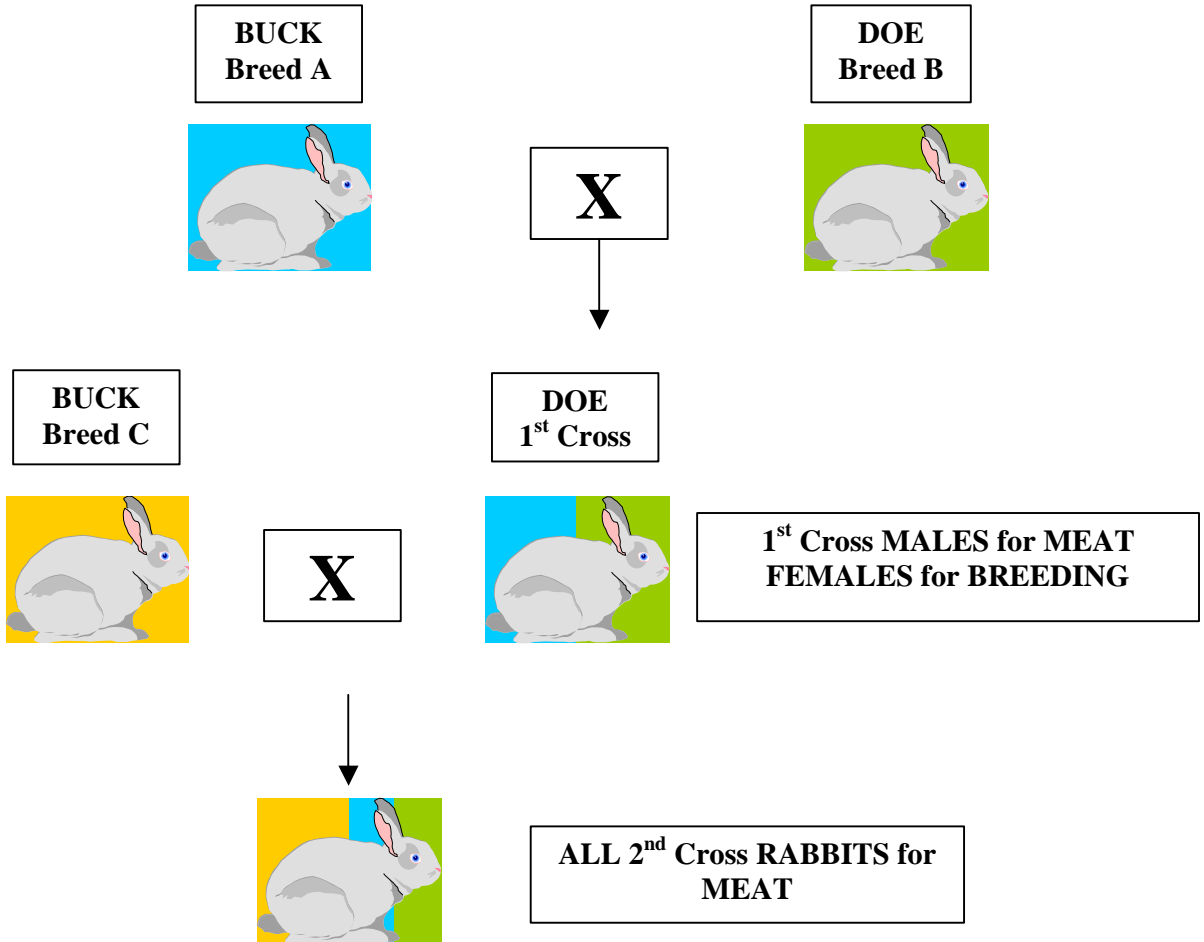
Helping answer this question is one of the primary goals of Crusader, the meat rabbit project being run by CSIRO Livestock Industries at Armidale (with support from the Rural Industries Research Development Corporation).

To investigate breed differences, the first piece of information needed is what breeds are available in Australia. This is important because rabbit importation is difficult and expensive due to quarantine requirements.

Surveys of rabbit farmers in NSW in 1999 showed that the predominant breed of meat rabbit being used is the New Zealand White, with a significant number of Flemish Giant and Californian rabbits. There are also other breeds being used but their numbers are small.

The three most common breeds – New Zealand White, Flemish Giant and Californian were chosen for evaluation in the Crusader Project. Pure breeds as well as some crosses of the three breeds were evaluated. The reason for doing the crosses is that you often get crossbred rabbits showing a significant level of “hybrid vigor” for traits such as litter size. However, there is a cost in maintaining the pure breeds for generating crossbreds, and crossing programs are only worthwhile if the pure breeds themselves give economic levels of production in their own right, and if crossbred rabbits produce more than either of the parent breeds.

Example of a 3-way cross-breeding program to maintain hybrid vigor



The benefits of hybrid vigor only appear in crossbred animals that have parents of completely different breeds. When a crossbred doe is mated back to one of the original breeds, her daughters will only express half of the hybrid vigor that she exhibited.

Hybrid vigor can be maintained if a third breed is available to which to mate the crossbred doe (see above figure). However, you soon run out of new breeds and a systematic way of crossing animals is needed if the level of hybrid vigor is large enough to warrant maintaining.

The alternative to this is simply to concentrate on one population of rabbits, selecting within that group for improved performance as a means of lifting production.

Crusader's first goal was to investigate the relative benefits of a structured crossing system based on 2-3 pure breeds, compared to a single breed selection program.

The original rabbits for Crusader were largely obtained as in-kind donations by rabbit farmers as a pledge of support for the project.

Some Californian and Flemish Giant rabbits were purchased (price range \$25-\$50) to supplement numbers provided as donations.

Rabbits were sampled from as many sources as possible (see table below) so that they represented the “average” for each breed generally available to rabbit farmers.

Breed of rabbit	Number of sources
New Zealand White (N)	19
Californian (C)	6
Flemish Giant (F)	4

Within each breed, matings between bucks and does from the same farm were avoided where possible, and individual bucks were mated to a number of does from different sources so that the genes from each farm were mixed together.

The breed crosses that were investigated in Crusader are given in the following table (male breed listed first).

Purebred	Crossbred	3-way Crossbred
N x N	C x N	C x (FN)
C x C	F x N	F x (CN)
F x F		

The purebred and crossbred rabbits were evaluated for reproductive and litter traits as well as for individual growth and carcass traits. The 3-way crossbreds were evaluated only for individual growth traits, as there were too few litters in the data set to evaluate reproductive traits.

Reproduction	Growth	Carcass
Number of kittens born per litter (NB)	Weaning weight at 5 weeks (g)	Slaughter liveweight (kg)
Number of kittens born alive per litter (NBA)	Liveweight at 10 weeks (g)	Carcass weight (kg)
Number of kittens weaned per litter (NW)	Growth rate (g/head/day)	Dressing percentage (%)
Average doe age at first successful mating (weeks)		
Conception rate from successful matings (%)		

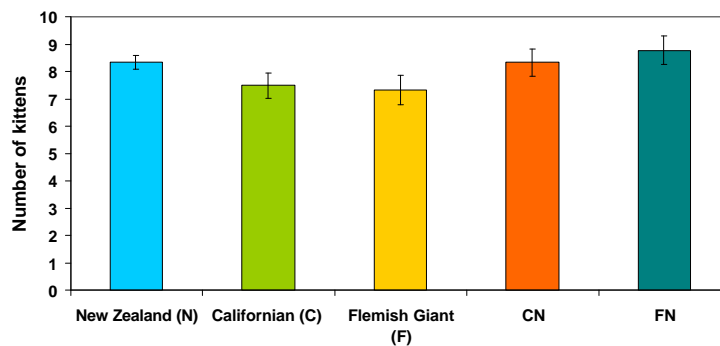
How did the breeds rabbits and their crosses perform?

Reproductive Traits of the Doe

- Litter size at birth averaged 8.1 kittens and all breeds were similar, with New Zealand and New Zealand crosses tending to be the highest.



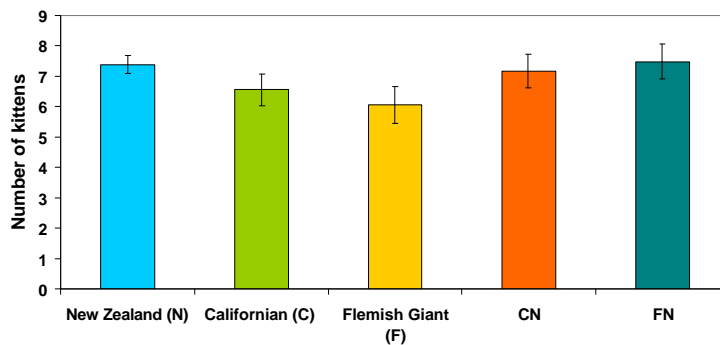
Litter Size at Birth



Rabbit breed with male parent listed first

- Number of kittens born alive averaged 6.9 per litter, with New Zealand and New Zealand crosses tending to be the highest. Although not statistically significant, there is a slight suggestion that purebred Californian and Flemish Giant rabbits have lower litter size born alive.

Number Born Alive

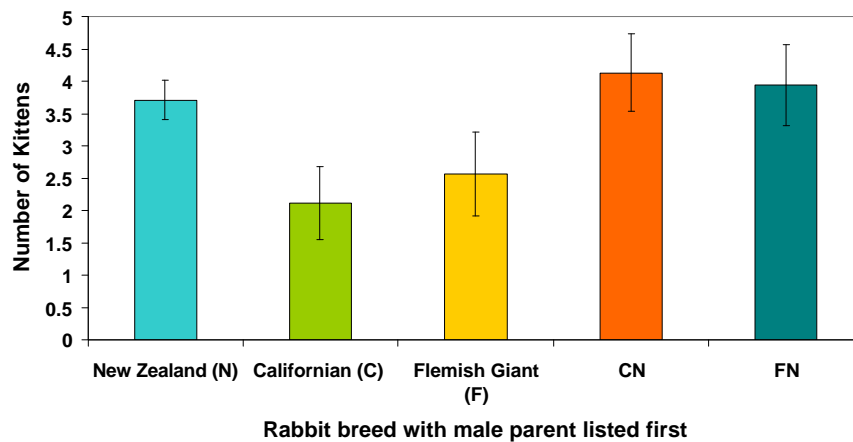


Rabbit breed with male parent in crosses listed first

- Averaged over all crosses, litter size at weaning was 3.3 kittens per litter, with purebred Californians and Flemish Giants performing poorly. New Zealand and New Zealand crosses were the best. Although these results demonstrate some hybrid vigor (the CN performance is better than the average of the two pure breeds), the level of hybrid vigor does not make the crossbred mother significantly better than the purebred New Zealand mother.

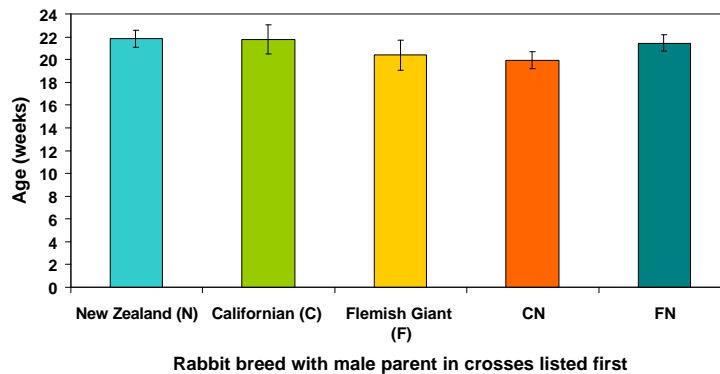


Litter Size at Weaning

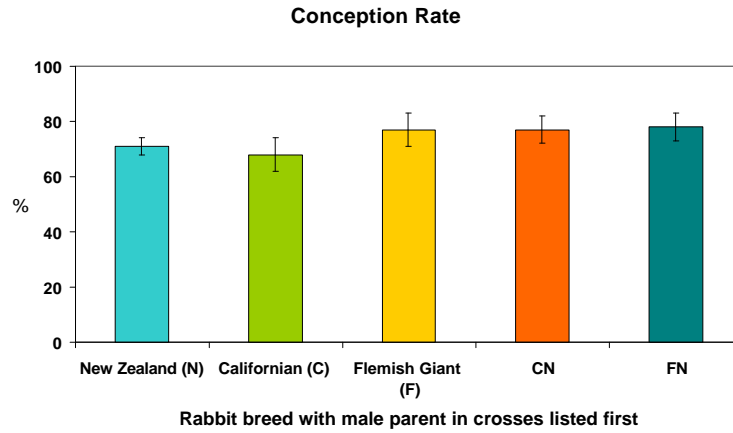


- All does were introduced to the weekly mating schedule at 18-19 weeks of age. Does of all breeds first successfully mated (accepted the buck) at the same age of about 20-22 weeks.

Doe Age at 1st Mating

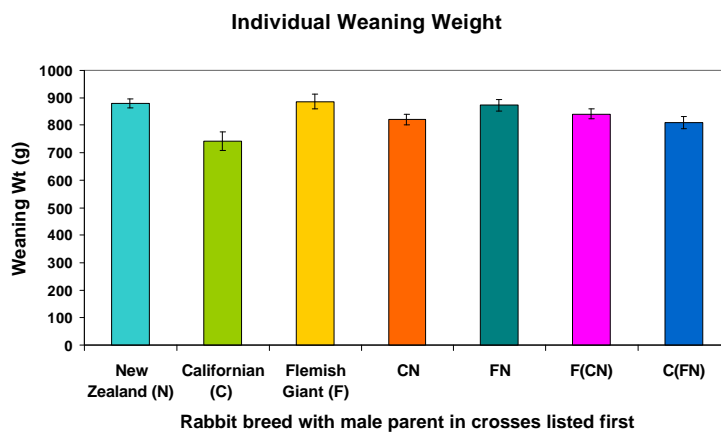


- Conception rate (combined over maiden and mature does) was similar for all breeds, averaging 75 %.

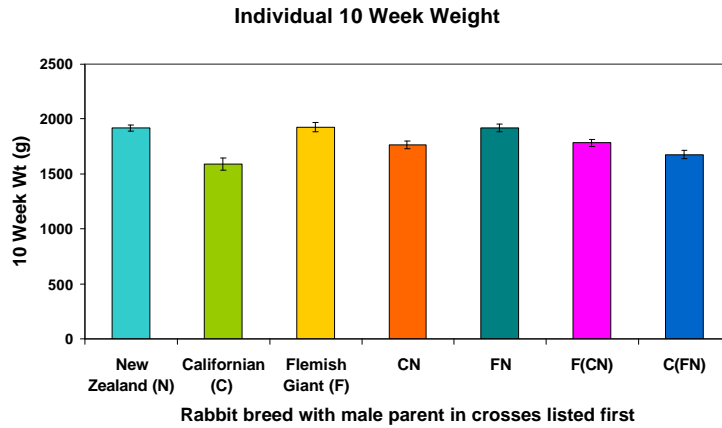


Individual Growth Traits

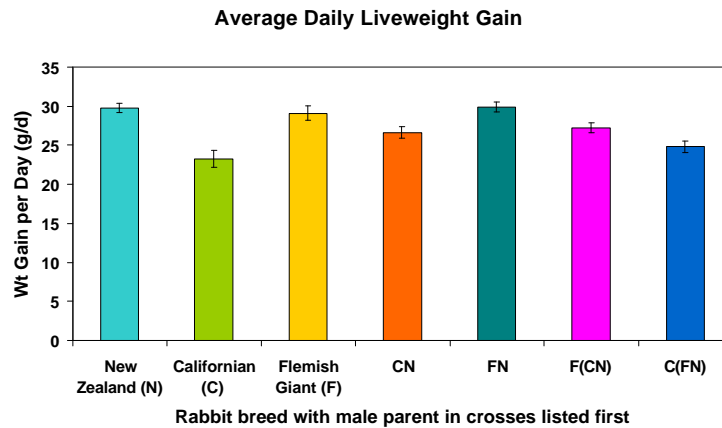
- There were significant differences in weaning weight with purebred Californian rabbits 11% lighter than the average of other breeds.



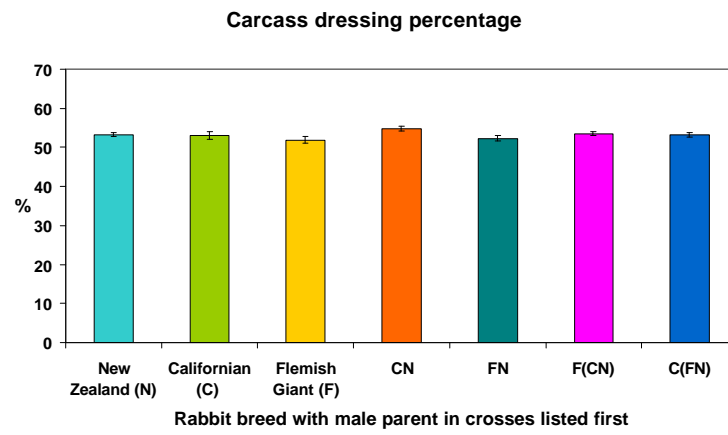
- These differences were still apparent at 10 weeks of age with purebred Californian rabbits 12% lighter than the average of other breeds. Crossbred rabbits with >50% Californian genes were also lighter than the other breeds and their crosses.



- There were significant breed differences in growth rate from weaning to 10 weeks of age, with purebred Californian rabbits growing 15% slower than the average for other breeds. Californian crossbred rabbits were intermediate for growth rate, while New Zealand and Flemish Giant purebreds and their crosses had the highest growth rates. There is no suggestion of “hybrid vigor” for growth traits, with crossbred performance being about midway between that of the parent breeds.



- Dressing out percentage averaged 53.2% and was similar for all breeds of rabbits.



The Crusader Breeding Program

Deciding on the Breed Structure

The breed evaluation gave a clear direction for the Crusader Breeding Program. However, the results should be applied to the rest of the industry with care. Although we sampled rabbits from as many farms as we could, there may still be large between-farm variation in merit that we have not accounted for in this study.

For reproduction traits such as litter size, purebred New Zealand does were just as good as crossbred does, indicating that the level of hybrid vigor being expressed is not large enough to warrant a structured cross breeding program. It would be unwise to base a breeding program on **purebred** Californian rabbits, and possibly Flemish Giant, because their reproductive performance was poorer than New Zealand Whites.

For growth traits, the New Zealand White and Flemish Giant purebreds performed the best, with similar results for the crosses of these two breeds. Purebred Californians grew the slowest and crosses with Californian were intermediate.

Given that crossbred and New Zealand White rabbits were very similar in performance, we had two options open to us:

1. Develop a superior line of purebred New Zealand White rabbits
2. Develop a synthetic or composite strain of rabbits by selecting the best individual rabbits irrespective of breed

The second option was the most attractive as it allowed us to select all the very best rabbits in the base population for breeding as well as ensuring a greater genetic diversity that would assist in management of inbreeding.

The breed mix of the base population bucks selected to date is given in the table below.

Buck Breed	Number in Base Population
New Zealand White (N)	17
Flemish Giant (F)	6
Californian x New Zealand (CN)	2
Flemish Giant x New Zealand (FN)	9
F(CN)	3
C(FN)	3
N(F(CN))	4

Selecting the Best Rabbits for Crusader

Crusader rabbits are selected to have high number of kittens weaned and high growth rate after weaning.

In time we also want to introduce resistance to disease as a selection criterion, specifically targeting resistance to Pasteurella and Staphylococcus bacteria that cause snuffles, pneumonia, abscesses and mastitis.

Individual rabbits are ranked on an index of economic merit that predicts the \$ return from using that rabbit in the breeding program. This is based on the Estimated Breeding Value of the rabbit for Number Weaned per litter (NW EBV) and Average Daily Gain in grams per day for grower rabbits (ADG EBV).

$$\text{Crusader Index (\$)} = (\text{NW EBV} \times \$34) + (\text{ADG EBV} \times \$11)$$

(The relative economic value for NW and ADG is the value of changing each trait by 1 phenotypic standard deviation, 2.8 kittens per litter for NW and 5.7g/d for ADG. An additional 2.8 weaners per litter is worth a lot more than an increase in growth rate of 5.6 g/d.)

The very best bucks are selected for the Crusader Breeding Program and used for a period of 6 weeks. From the male offspring produced during this time, the best young buck is chosen to replace its father. This pattern allows a balance between genetic gain and inbreeding.

What Crusader Offers Rabbit Farmers

Rabbit breeders can link to the Crusader Breeding Program by using Crusader bucks with their own does. This provides the genetic link needed to allow on-farm rabbits to be compared with Crusader rabbits. Two New England rabbit farms have already taken up this option so that they can identify new bucks that are of high breeding merit, rather than buying an unproven buck.

Farmers can purchase 12 week old bucks or does that have breeding values just below that of the rabbits chosen for mating in the Crusader Breeding Program.

Need more information?

More information about Crusader can be found at our web site www.csiro.au/crusader or by contacting Dr Sandra Eady, Sandra.Eady@csiro.au or phone 02 6776 1394.



“What’s up Doc?”