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A new tiered registration system for Nadudana Cattle in Australia

Background:

Nadudana cattle were first introduced to Australia in 1995. A Breed Association has existed for most of the period since this introduction to attempt to monitor and support the development of the breed in the country. This Association has undergone several iterations which has created some inconsistencies in the herd book and the registration system. It is understood that significant interbreeding has occurred since this introduction and it is not clear if there are any truly pure Nadudana remaining whose lineage can be traced back fully to these original introductions without any crossbreeding (i.e. Foundation Pure). The membership of the current association (Nadudana Association Australia) is limited to just a handful of breeders. The current committee considers that there are a significant number of Nadudana cattle in Australia that could potentially qualify as Nadudana that are currently not registerable because they do not have full pedigree data and possibly some cattle that are just as good as registered cattle but with no documented breeding history. This includes cattle owned by existing members which can be quantified but it is also likely that there are potentially an unknown number of Nadudana owned and bred by studs that are not registered or by breeders that are not currently members of the Association. These Nadudana may have full or partial pedigree but many are likely to have no documented breeding history. It should be noted that, without any documented breeding history, there is no knowledge whether an animal with adherence to breed standard, is likely to breed true.

Objective:

The objective of this paper is to present a potential framework for a more flexible registration system with different categories of registered cattle in the herd book which can enable many of these currently unregistrable cattle to be brought back into the herd book to expand the national herd to help ensure its survival as a rare breed. It is also important, given the past history of the breed and the crossbreeding that has occurred, and given that Nadudana are rarely exhibited and thus evaluated in cattle breed shows, that the registration system ensures that breed standards are maintained and ultimately, that the national herd has the highest proportion of cattle that meet the breed standard.

This proposal was presented to and discussed by members at a General Meeting of the NAA held in December 2022 and following modification was adopted by members at the NAA's

Annual General Meeting held in February 2023. When considering this document it is important to bear in mind the complexities of breeding systems and to bear in mind the need to have clear strategies for future breeding and upgrading of cattle to build the numbers of purebred Nadudana.

Proposed registration criteria:

The basic principle is that we can have a tiered partially open system where we have a **Main Registry** for cattle that have a known Nadudana pedigree and then we have an **Appendix Registry** allowing registration for cattle with incomplete pedigrees, upgraded cattle with crossbred pedigree and appearance certified' or 'approval on merit' cattle which have the appearance of Nadudana but with no documented breeding history. It may be that the Appendix Registry would eventually become obsolete when the majority of Nadudana in Australia are fully registered in the Main Registry and we have reduced the level of threat to the future of the breed as classified by the Rare Breeds Trust of Australia.

These registration categories could be based on criteria as proposed in [Table 1](#). There are some complexities in this system and this may be unavoidable if we are to achieve the objectives outlined above.

Main Registry of Purebred and Foundation Pure Nadudana

This is an adaptation of the existing system where cattle require full pedigrees (with up to four generations of ancestry) to be registered as Purebred. Purebred animals in the Main Registry must meet the criteria as minimum 87.5% purebred based on available pedigree or lineage information. This can only be established by provision of certified pedigree breeding history validated by DNA testing. Registration can be made early in the life of the calf as soon as DNA data is available to confirm the pedigree. Furthermore, the lineage history may identify an animal as Foundation Pure (FP) meaning that its entire lineage can be traced back to the original imported Nadudana without any crossbreeding in its ancestry.

It is understood that not all purebred cattle will conform strongly to the breed standard although they must meet the standard in not having any disqualifying traits. Experienced breeders are expected to prioritise the breeding of bulls and cows that adhere most closely to the agreed breed standard. New breeders will be advised by the NAA and mentored by existing breeders to best ensure that they breed appropriately. Disqualified cattle (based on disqualification traits in the breed standard) cannot be registered and cannot be used in breeding for purebred registration purposes.

Appendix Registry for upgrading Nadudana

The Appendix Registry is for cattle for which full lineage is not available and that cannot be registered in the Main Registry but may still have useful contributions to make to the national herd. The intention is that breeders should register their cattle in the Appendix Registry with a view to using them in an upgrading programme by crossing them to animals in the Main Registry. Cattle that can be considered for appendix registration include:

- i) F1 and backcross crossbred Nadudana;
- ii) Nadudana with partial pedigree documentation; and

- iii) Cattle that are considered to be Nadudana based on their appearance and their adherence to the breed standard but with no documented breeding history.

Table 1 Table of proposed criteria that could be used for a tiered registration system for Nadudana cattle in Australia

Category	Suggested Criteria	Designation	Notes
Main Registry			
Full Registration Foundation pure	Full 4 generation pedigree verified by DNA testing where evidence exists that the full lineage of the animal can be traced back to original imports (i.e. 100% purebred).	FP xxxx	These are the purest Nadudana for which the ancestry can be traced back to the original introductions of Nadudana into Australia. Evidence must be presented of ancestry traced back to the initial introductions.
Full Registration Purebred	Full 4 generation pedigree verified by DNA testing and meeting minimum level of purity (87.5%).	PB xxxx	This is a registration based on pedigree information provided by the owner/breeder but without evidence that they are Foundation Pure.
Graded Full Registration Class A or B	Full 4 generation pedigree verified by DNA testing and meeting minimum level of purity (87.5%).	FP xxxxA FP xxxxB PB xxxxA PB xxxxB	These are purebred or Foundation Pure Nadudana which owners have submitted for voluntary grading. Class A animals will have the strongest adherence to standard whereas Class B will have lower adherence.
Partial pedigree	75% pedigree Class A	PB xxxxA	An animal for which registered pedigree is available for three out

			of four grandparents and which are assessed to have strong conformity to standard (i.e. are graded as Grade A standard). These animals are likely pure Nadudana but with some missing information.
Partial pedigree	50% pedigree Class A	PB xxxxA*	An animal for which registered pedigree is available for two out of four grandparents and which are assessed to have strong conformity to standard (i.e. meet Grade A standard). These animals are likely pure Nadudana but with half of pedigree information missing. These may not be used for upgrading.
Appendix Registry			
Appendix Registration Appearance Certified ¹ Class A	Graded on appearance (at age 3+). Grade score above threshold for acceptance as Class A	AP2 AC xxxxA	These are animals that have good adherence to the Nadudana standard but have no breeding history. Many of these may be pure Nadudana (just lacking evidence) and this category will enable more rapid integration of their genetics into the national herd.

¹ Also known as approval on merit

Appendix Registration Appearance Certified Class B	Graded on appearance (at age 3+). Grade score below threshold for acceptance as Class A but above threshold for consideration as Nadudana type	AP1 AC xxxxB	This can be used for registering animals that don't have pedigree data or have minimal documented breeding history. Should be animals that meet a minimum conformity to the standard but cannot be classified as Class A.
Appendix Registration Crossbred F1	F1 crossbred between PB or FP stock and another breed 50% Nadudana	AP1 CB xxxx	This category is to support upgrading of cattle to increase genetic variability in the breed.
Appendix Registration Backcross	Backcross between F1 crossbred and PB/FP stock 75% Nadudana	AP2 CB xxxx	This category is to support upgrading of cattle to increase genetic variability in the breed but represents $\frac{3}{4}$ Nadudana genetics.
Partial pedigree	50% or greater pedigree Class B	AP2 PP xxxx	Reflecting that the animal might be pure bred but does not adequately meet standard

Only PB/FP animals will be used in the census of the status of the breed.

Table 2 Summary of the different categories of registration

Category	Description	Types
FP	Foundation Pure, 100% lineage traced back to imports	Full pedigree of pure Nadudana
PB	Purebred, $\leq 12.5\%$ crossbred ancestry Nadudana	Full pedigree of pure Nadudana and graded as Class A $\frac{3}{4}$ pedigree of pure Nadudana and graded as Class A

		½ pedigree as pure Nadudana and graded as Class A
FP-A/B	Foundation Pure, voluntarily graded	Foundation Pure with voluntary grading as Class A (strong conformity to standard) or Class B (weak conformity to standard)
PB-A/B	Pure bred, voluntarily graded	Full pedigree of pure Nadudana with voluntary grading as Class A (strong conformity to standard) or Class B (weak conformity to standard) Also includes class A graded animals with only 75% or 50% ² of lineage available but classed as Class A.
AP-1	Appendix registered needs two generations of upgrading to attain main registry	Appearance certified, meets minimum standard but not Class A F1 (50% pure) crossbred animal using FP/PB parent
AP-2	Appendix registered needs one generation of upgrading to attain main registry	Appearance certified, graded as Class A, strong conformity to standard 75% crossbred/backcrossed animal using FP or PB parent Partial pedigree (50% or 75%), meets minimum standard but not Class A

The system would also need to allow for upgrading of progeny from Appendix Registry parents to the Full Registry and this needs to be considered and debated as it introduces further complexities. A proposed system for upgrading based on the possible types of crosses is presented in Table 3.

² If only 50% of pedigree is available these animals may not be used for upgrading

Table 3 Foundation Pure and upgrading options for crosses of different categories of registered cattle.

Parent A	Parent B	Designation	Notes
<u>Purebred breeding</u>			
FP	FP	FP	Can be voluntarily graded at 3+
FP	PB	PB	Can be voluntarily graded at 3+
PB	PB	PB	Can be voluntarily graded at 3+
<u>Grading up breeding</u>			
FP/PB	AP-1	AP-2	Considered 75% pure
FP/PB	AP-2	PB	Considered 87.5% pure
FP/PB-A	AP-1	AP-2	Purebred has been voluntarily graded as Class A
FP/PB-A	AP-2	PB	Purebred has been voluntarily graded as Class A
FP/PB-B	AP-1	AP-2	Purebred has been voluntarily graded as Class B
FP/PB-B	AP-2	AP-2	Purebred has been voluntarily graded as Class B
AP-1	AP-1	AP-1	
AP-1	AP-2	AP-1	
AP-2	AP-2	AP-2	

Grade scoring classes of animals

If we are to include conformity to standard as part of the criteria for registration to be applied (voluntarily) to manage quality in Purebred stock and for appearance certification it will be necessary to develop a grading system for assessing conformity to standard. Physical on-site inspection of cows is not really an option due to the cost of organising assessment by qualified individuals and the fact that Nadudana are rarely shown in front of judges.

It is thus proposed that an assessment system is developed based on photographs and accompanying declarations. These submissions can be evaluated and categorised by one or more qualified assessors in a grading committee, members of which are appointed by the NAA. However, one of the challenges here is that the breed standard (see [Table 1](#)) applies to adult animals, particularly for size criteria but also for characteristics such as horns. Thus conformity to standard can only really be assessed in mature animals at over 3 years old.

For animals in the main registry they can be registered shortly after birth provided the DNA evidence and documented lineage certification can be provided.

Appendix animals will need to be graded as adults (3+). The grading assessment will have threshold scores dividing cattle into Class A, Class B and unregistered. With the thresholds to be established when NAA has developed and evaluated a grading scheme.

Owners with cattle with only partial pedigree or no pedigree could apply to register their unregistered animals under the Appendix Registry standard unless they meet the grading standard criteria for inclusion in the Main Registry.

Any already Registered animal (in Main or Appendix Registry) may be voluntarily submitted for grading. This is for the owner's own interest and to inform their own breeding decisions but does not impact the future classification of its progeny in either Registry.

The grading system will need to be standardised and based on weighted importance of all the elements of the standard. Once the Registry system is agreed members can be consulted on developing the grade scoring systems based on such weightings. A fee structure for registration (including a grading fee when applied) on the assumption that NAA may need to pay a fee for one or more grading assessors. We would also need to develop a standardised procedure for preparing submissions for grading including details of the data and photographs to be provided.

It is proposed to create an ad hoc sub-committee to develop a proposal for the grading system, to be reviewed and approved by the committee and the membership.

Some worked examples:

Example 1: An example of appearance registration (registration on merit) and subsequent upgrading:

An owner/breeder has a cow that he believes to be pure or mostly pure Nadudana, it looks like a Nadudana and has reasonable conformity to standard. The owner wants to register the animal in the Appendix Registry. He looks up the grading details and submits a registration application and grading form with photos. The NAA grading committee grades the cow as Class A (strong conformity to standard). The cow is registered with NAA in the Appendix Registry as category AP2. The owner then crosses this cow with a purebred bull registered in the Main Registry. He then submits the calf for registration in the full registry which is agreed by the Registrar and the owner is issued a certificate for the fully registered animal which shows only the parents but no earlier generations are indicated for the parent cow's lineage which is unknown.

(Note: the calf would be classed as purebred but due to the lack of 50% of the lineage it could not be used for upgrading)

Example 2: Registration of a Nadudana with partial pedigree:

An owner breeder has a bull which he purchase as a Nadudana but the previous owner is unable to verify the registration on one of the grandparents. The owner submits the registration request with the certification details for three of the four parents. The owner also requests his bull to be graded by the NAA grading committee. The grading identifies the animal as Class A and the bull is registered in the Main Registry as a purebred.

(Note 1: the same result would occur if only 50% of the lineage was submitted and the bull was listed as Class A but the animal could not be used for upgrading).

(Note 2: if the bull was graded Class B it would be registered in the Appendix Registry as AP2)

Example 3 – Crossbreeding

An owner/breeder crosses a registered purebred Nadudana from the Main Registry (but not an F1 progeny from a 50% pedigree or an appearance certified animal – see examples 1 and 2) with another breed (lets say a Dexter). The owner submits the F1 heifer progeny for registration in the Appendix Registry. It is registered as a crossbred with category AP1. The owner then breeds the AP1 F1 crossbred cow back to another pure bred bull from the Main Registry and submits that F2 back cross male calf for Registration in the Appendix Registry. It is registered as a crossbred with category AP2. The owner then crosses that bull with a purebred Cow from the Main Registry and submits that calf for registration in the full Registry. It is registered in the Main Registry under the category PB.