Rabbit breed characteristics, farmer objectives and preferences in Kenya: A correspondence analysis

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Abstract:

Rabbit production is becoming important in Kenya not by young boys but as an economic undertaking. This may be due to decreasing per capita landholdings due to increasing human population density. However, there is little published information on requirements for successful rabbit production. A study was designed to characterize the rabbit production systems to allow identification of constraints and opportunities along this particular value chain. Respondents in a survey were purposively selected from four regions of the country where there is significant rabbit farming activity according to the Ministry of Livestock Development. These included Rift Valley, Central, Eastern and Coastal region. Structured questions were asked, several rabbit breeds and their crosses were identified and the study sought to couple farmer stated objectives with these breeds. The coupling of breeds to the stated farmer assessment of their traits and benefits was also attempted. This was implemented through the application of Correspondence Analysis on these frequency data. Results indicated that there was considerable rhyme between farmer stated objectives and the rabbit breeds that they kept while this correspondence also stretched to breed and the farmers stated qualities of the breeds. These results therefore showed that stated inherent qualities of the breed also might direct farmer choices. Whereas slightly over half (52.3%) of the farmers kept rabbits with a commercial intention, the findings from the analysis indicate that some heavy breeds such as French ear Lop and the Flemish Giant score highly for their carcass weight. That these breeds have a poor bone-meat ratio unlike the more popular New Zealand White and Californian White indicate that farmers do not consider the true value of the product such as bone:meat ratios. In a commercial enterprise, these results are perplexing and serve to show that farmers may require more capacity to appreciate the inherent breed characteristics rather than just the overtly recognizable breed characters.
Keywords: Correspondence analysis

JEL Classification: Q12, C18, C10

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1.0 Introduction:

Most of the world population is fed on food produced on small farms which have continued to get smaller as the human population pressure increases (McIntire et al., 1992). This has led to the need to search for alternative protein sources that are cheap, readily available and posing minimal competition to man (Akinmutimi, 2007). Rabbits (Oryctolagus caniculus) have therefore become a viable option, because of their proverbial prolificacy, early maturity, fast growth rate, high genetic selection potential, high feed conversion efficiency and economic utilization of space (Lebas, 1997; Hassan et al., 2012). To ensure a sustained rabbit production and development of the sector, rabbit breeds and breeding practices should be explored and challenges identified. The rabbit is an induced ovulator with the sexually mature doe exhibiting numerous follicles (Harkness and Wagner, 1983). On mating, the act of copulation stimulates hormonal reaction resulting in ovulation 10 hours later (Paufler, 1985). The doe can theoritically be bred 24 hours after parturition and has a gestation length of 28-32 days and can give upto 11 litters in a year. Rabbit breeds are distinctively identified phenotypically by the body size, shape and the coat color (Lebas et. al., 1997). Using this basis of classification, American rabbit breeders association (2010) have recognized 47 distinct rabbit breeds of which only a few are kept in Kenya (MOLD, 2010). The most common rabbit breeds in Kenya include: New Zealand white, Californian, Chinchilla, French Lop, Dutch, Checkered giant, Flemish giant, Angora and Rex. Rabbits have further been classified as: small sized rabbits weighing about 1.4 – 2kg at maturity, medium sized breeds weighing 4–5.4kg, and large breeds weighing 6.4 – 7.3kg (USDA, 1972). In this classification New Zealand white and Californian white are medium sized breeds. They are the most popular for meat production due to good growth characteristics and a high meat: bone ratio (Oseni, 2008; Mailafia et al., 2010). The New Zealand white is also well recognized as a dam breed based on its outstanding maternal genetic merits for litter size, milking, and general mothering ability (Lebas et al., 1997; McNitt et al., 2000). The good attributes of the two breeds are due to their specific selection for improved reproductive performance (King, 1978; Owen, 1981). However, rabbit breeding experiments in the U.S.A. have documented the New Zealand White as generally inferior to crosses for post weaning fryer growth, feed utilization and carcass lean yield traits (Ozimba and Lukefahr, 1991; Lukefahr et al., 1992). Other common meat breeds are Flemish giant, French ear Lop and Checkered giant mainly because of their large size. Smaller breeds, on the other hand, are mostly kept as pets and include Chinchilla, Dutch and the Angora (Moreki, 2007). In this study, the common rabbit breeds kept in Kenya were identified; selection characteristics, reasons for breed preferences and breeding challenges amongst rabbit farmers were identified.

2.0 Materials and Methods

Stated Preference valuation methods have been used to value livestock traits in Kenya (see for example Ouma et.al., 2004; Omondi et.al., 2008; Ruto et.al., 2008) and in West Africa (Tano et.al., 2003). The methods have also been applied to estimate preferences for pig breeding traits under different production systems (Roessler et.al, 2007) as well as sheep (Duguma et.al., 2011). Using Conjoint Analysis (CA), a study in Western Kenya reveals that farmers discounted animals with low disease resistance and a high feed requirement and preferred those with high milk yield and low feed requirement (Makokha et.al.,2007). Similarly, crop attributes have been

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valued using choice experiments (CE) (Edmeades, et.al., 2008; Asrat et.al., 2009). For instance, a study in Kajiado utilizing Choice experiments reported that traders preferred exotic breeds over local breeds while farmers buying local breeds for breeding purposes preferred female animals (Ruto et.al. 2008). Earlier work had shown that the CE could as well estimate phenotypic traits in cattle just as revealed preference approaches (Scarpa et.al., 2003). However, these are valuation studies and for valuation using the choice experiment approach, it is important that major traits are considered during the development of the choice sets. Besides, it is assumed that farmers will make decisions of keeping a particular livestock after evaluating whether their farm is suitable for the livestock, whether a market for the livestock product is available, and whether availability of inputs is problematic. This information is important since there is need to consider the variable socio-economic and cultural values of livestock and incorporating these into breeding programs (Philipsson et.al., 2011).

Besides valuation of individual product attributes, marketing researchers have also used various approaches to qualitatively position the characteristics of services or even products. For instance, (Gursoy et.al. 2005) use Correspondence Analysis (CA) to examine the relative positioning of the 10 major US airlines based on 15 attributes that measure actual airline performance on critical quality criteria important to consumers. Greenacre & Torres (2003) use the method to link deodorant brands and their benefits. Unlike the many statistical techniques that test hypotheses that have been formed a priori, correspondence analysis (CA) is an exploratory data technique that explores categorical data for which no specific hypotheses have been formed (Storti, 2010). Correspondence Analysis (CA) has found extensive use in ecology, archeology, linguistics and the social sciences as a method for visualizing the patterns of association in a table of frequencies or nonnegative ratio-scale data. The mechanics of linking the association of responses contained in a table of row and column responses proceeds by decomposing the chi square (χ^2) from contingency tables. It allows for the representation to this table in low-dimensional space—an explorative computational method for the study of associations between row and column entries in a contingency table. Just like principal component analysis, it displays a low-dimensional projection of the data, and is closely linked with the χ^2 test for homogeneity in a contingency table where when there is an association between rows and columns of the table, the value of the underlying χ^2 statistic is high. In CA, points are depicted such that the sum of the distances of the points to their centroid ("total inertia") is proportional to the value of the χ^2 statistic of the data table. The farther away a point is from the centroid, the higher is its row's contribution to the value of that statistic. In this sense, CA decomposes the overall χ^2 statistic such that the distance is low when the profiles of two vectors show similar shape, independent of their absolute values. The aim is to embed both rows (characteristics of breeds) and columns (rabbit breeds) of a matrix in the same space, in the first two or three coordinates which contain the bulk of the information.

A questionnaire was designed to collect farm level data pertinent to rabbit production and consumption among 300 rabbit farmers. Respondents were targeted from the counties viz; Nakuru, Kiambu, Taita Taveta, Nyeri, Meru, Kirinyaga and Tharaka Nithi (figure 1) between August and September 2011. Of interest to this paper were questions which required farmers to state answers to the question "What is the main objective of keeping rabbits". They subsequently, enumerated from a list of possible choices, the qualities that led them to choose

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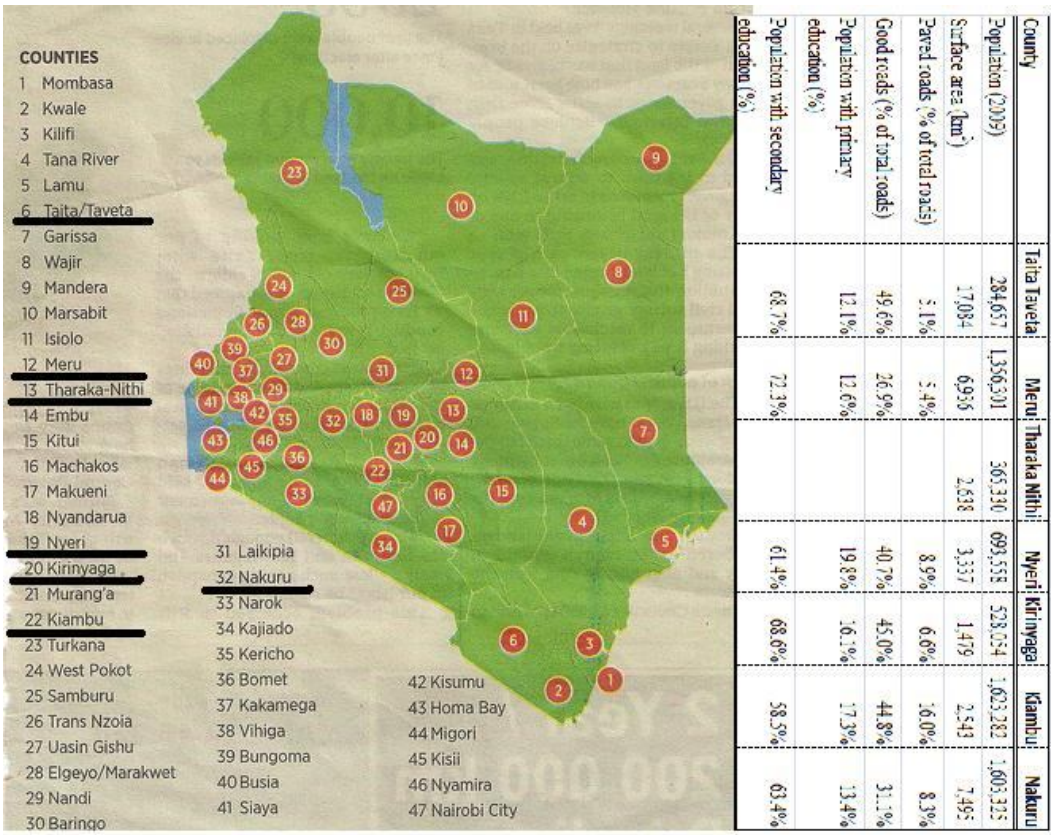
their preferred breed. The available list of options, farmers chose among the following qualities; fur (FU), mothering ability (MO), carcass weight (CA), availability (AV), number of offspring (OF), best as pets (PE), other farmers preference (OT), disease resistance (RE), Beauty (BE), Growth (GR), ability to forage on wide variety of forbs (FO), and market price (PR). Farmers were also allowed to indicate any other qualities that drew them to certain breeds. In addition, farmers also had a chance of identifying from the portfolio of breeds that they had on the farm their preferred breed. Designed this way, it was possible to associate various breeds with their inherent characteristics from a farmers' perspective and also the farmer's driving objective of keeping rabbits. The analysis is implemented using **R** software utilizing the ca package (Nenadić, & Greenacre, 2007). Intepreting the results are provided using the guide by (Bendixen, 2003)



County	Taita Taveta	Meru	Tharaka Nithi	Nyeri	Kirinyaga	Kiambu	Nakuru
Population (2009)	284,657	1,356,301	365,330	693,558	528,054	1,623,282	1,603,325
Surface area (km²)	17,084	6,936	2,638	3,337	1,479	2,543	7,495
Paved roads (% of total roads)	5.1%	5.4%		8.9%	6.6%	16.0%	8.3%
Good roads (% of total roads)	49.6%	26.9%		40.7%	45.0%	44.8%	31.1%
Population with primary education (%)	12.1%	12.6%		19.8%	16.1%	17.3%	13.4%
Population with secondary education (%)	68.7%	72.3%		61.4%	68.6%	58.5%	63.4%

Figure 1: Map indicating study areas

3.0 Results and Discussion

The interviewed farmers kept an average of 20 animals, close to that observed in the island of Crete; Greece—where rabbit meat is a traditional dish (Christodoulopoulos et.al, 2001) with farmers in Central yielding an average of 32 rabbits while there were just 9 rabbits per farmer in the Coast region. Over half of the farmers actually kept between 1 and 10 rabbits with 22.5% of the farmers keeping more than average of 20 rabbits implying that many of the farmers keep small numbers. Over half of the farmers (53%) of the farmers kept rabbits mainly for commercial

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purposes while 37% did so for home consumption. Only 10% considered keeping rabbits as pets while 0.3% kept them as a source of manure. Thus rabbit farming among the respondents was directed towards acting as a source of income while also acting as supplementary protein source for the home.

The rabbit breeds recorded on the farms included New Zealand White (NZW), Californian White (CW), Chincilla (CH), Dutch (DU), French Ear Lopped (FEL), Flemish Giant (FG), Kenya White (KW), Angora (AN), English Rabbit (ER), Checkered Rabbit (CKD) and their Cross Breeds (CB) (figure 2). Breeds such as the AN, ER, CKD and KW were not very popular since on all occasions, only less than 1.5% of farmers kept these breeds. The NZW, CW and CH were more popular while the crossbreeds were equally a popular choice among the respondent farmers. The NZW and CH were initially bred for meat and fur while the CW was bred as a cross between the NZW and the Himalayan and have a good meat to bone ratio. Two percent of the farmers were not sure of the breed type they were keeping however.

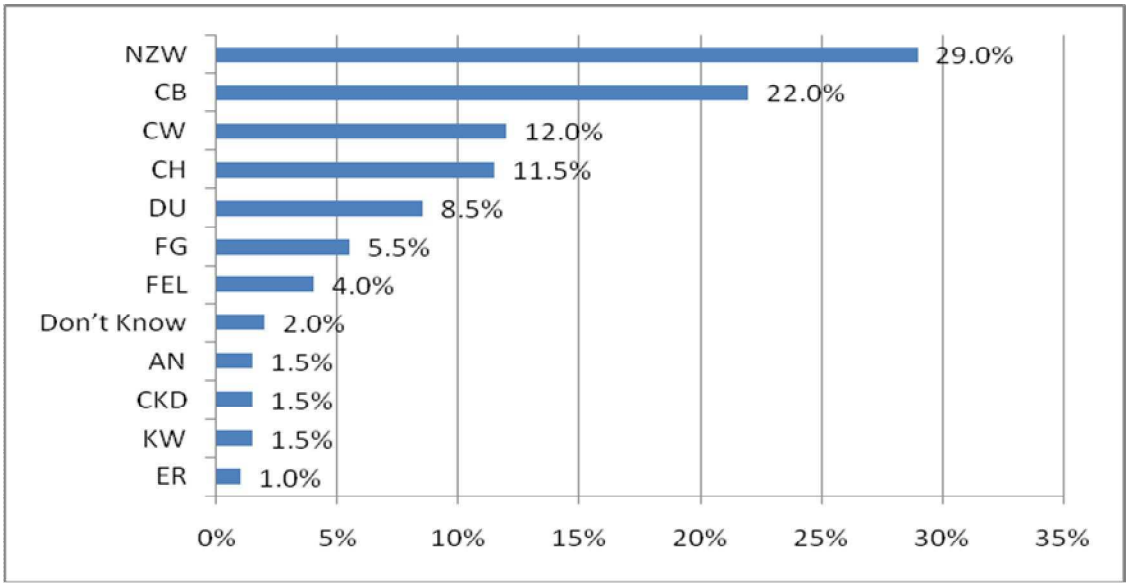

Figure 2. Percent farmers keeping various rabbit breeds

The major reasons for preferring each of the most common breeds according to the rabbit farmers are shown on figure 3. It is clear that carcass weight was a major factor for 34% of all farmers in the choice of breeds. Mothering ability and the number of offspring were also considered important for 28% and 23% of the farmers respectively while price came fourth with 16% of the farmers indicating it as a reason for breed preference. That a breed was available or that it is good for fur did not turn out to be very important choice parameters considered by farmers. For instance, for larger bodied breeds such as the Flemish Giant (FG) and the French Ear Lopped (FEL), they were preferred for their high carcass weight at slaughter. The FEL could also fetch attractive market prices as was the feeling of many keeping this breed. On the other hand, the most common rabbit breed, the New Zealand White (NZW) was preferred mostly for its good mothering ability, number of offspring and high carcass weight while the same seemed to be true for the Californian White (CW). These two medium sized rabbit breeds, New Zealand

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white and California white, weighing 3.6-5.9kg are the most popular for meat production in the world because of their good growth characteristics and a high meat: bone ratio (Mailafia *et al*, 2010; Oseni, 2008). Some of the characteristics such as high growth rates or the ability to consume a large range of forages did not feature much as a reason for preference. With respect to prices, it also appears that breeds with a high carcass weight are also preferred for they can fetch a high market price at sale. Also striking was that the French Ear Lopped and the Flemish Giant were not considered beautiful and as such did not feature as much pets compared to the Dutch or the Chinchilla. That a breed is chosen because it would produce good fur did not feature much as a feature to base breed choice upon. This result probably indicates that rabbit fur is not yet in the minds of many producers. Whether this is an indication of lack of knowledge about the use of rabbit fur or indicative of techniques of producing items from fur is not discernible from the data. That a breed was most available also did not feature much as a reason for preference meaning that farmers chose these breeds based more on some intrinsic qualities that each breed can confer.

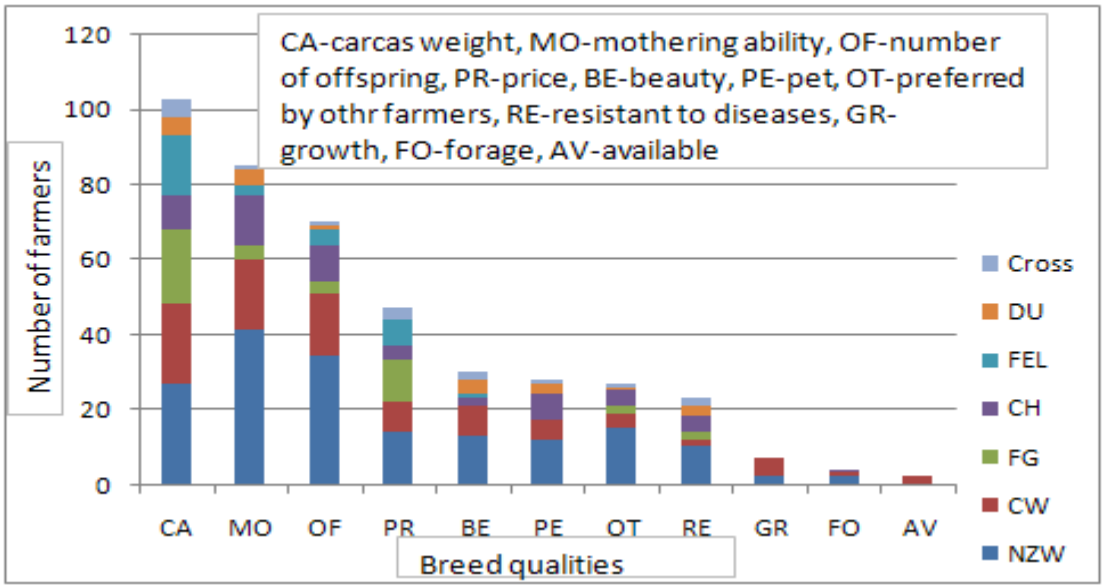

Figure 3: Reasons cited for prefering different breeds

A Chi Square value of 793.82 is calculated and this leads us to conclude that there is a significant dependence between the breeds and objective of farmers (P=0.10). To look more keenly at the associations between these categories of responses, we begin by looking for significant dependency between the rows and columns and this significance is established since the square root of the trace (i.e. √.103=.32>.2) which indicates significant dependency (see Appendix 1). About 94% of the chi square for association between farmer's objective of keeping rabbits and the choice of breed is accounted for by two dimensions, with most (76%) of that attributed to the first dimension. Commerce contributes 32.2% of the inertia while pet and consumption contribute 24.6% and 37.2% respectively. As it turns out, manure does not appear to determine the choice of breed but commerce, consumption and pet are significant in the choice of breed.

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There is also a strong correspondence between the choice of large breeds capable of producing high carcass weights—and therefore able to fetch good prices—and the major objective of farmers being commerce (figure 4a). The breeds in question are the Flemish Giant and the French Ear Loped. On the other hand, Chinchilla appears to be more of a pet than other breeds. For farmers who keep rabbits mainly for home consumption, the breeds they prefer are the Californian White, the Dutch and crosses (CW & NZW). From these figures, it is evident that in case one wills to promote selected breeds, the objectives of farmers also need to be taken into account since not all farmers have a commercial orientation. For instance in Taita Taveta, none of the farmers appears to have had an interest in commercialized rabbit farming while in Central (e.g. Kiambu), there was a noted interest in commercial rabbit farming since there is a larger number of large scale farmers[2] 6.7% in Kiambu compared to none in Taita Taveta.

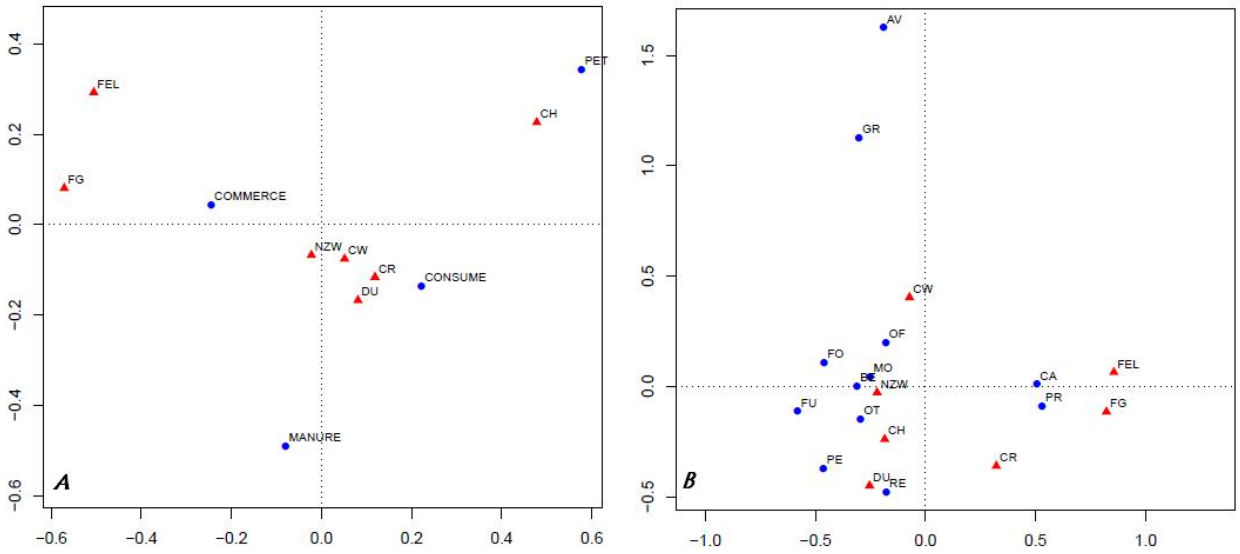

Figure 4: Correspondence between A) preferred breed and farmer objectives B) preferred breed and breed qualities

About 78% of the chi square for association between attributes of the breed and breed choice is accounted for by two dimensions, with most (55%) of that attributed to the first dimension (appendix 2a). Figure 4b shows that breeds that are preferred principally for their price and carcass weight are the French Ear Loped and the Flemish Giant although the latter for instance is classified as a breed that has a slow growth and has a high bone to meat ratio. These are the same breeds which are preferred by farmers who have commerce as a major objective of rabbit keeping. That the NZW and the CW rank lowly as a commercial breed is rather unsettling since On the other hand, the Dutch scores high for beauty and as a pet. The high growth rate of some breeds, mothering ability, as well as many offspring appears to be the driving force behind those who prefer the New Zealand White, the Californian White as well as the Chinchilla. That FG and

[2] >50 does

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FEL are considered for their prices and carcass weight is interesting given that these have a high bone-meat ratio leading us to believe that this fact might not be known to many respondents. It is probably the crosses that appear to be closing in as important for their price than their parents (NZW & CW). This means that a closer examination of such interaction between the prices of different breeds be made to establish what the main points are when setting these prices. From the design of the study, it was not immediately clear if these prices were selling or buying prices, hence the need for such clarification.

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Appendix 1a: Eigenvalue report (Breed & Farmer objective)

Axis	Eigenvalue	Individual	Cumulative
1	0.078980	76.3	76.3
2	0.018959	18.3	94.6
3	0.005585	5.4	100.0
Trace	0.103524		

Appendix 1b: Detailed reort: Eigenvalue report (Breed & Farmer objective)

Variable	Mass	Quality	Inertia	K=1	Correlation	Contribution	K=2	Correlation	Contribution
Rows									
Manure	4	152	60	-80	4	0	-490	148	49
Commerce	537	1000	322	-245	969	409	44	31	54
Consumption	375	994	246	222	722	233	-136	272	365
Pet	85	996	372	577	734	358	345	262	532
Columns									
NZW	382	398	47	-22	40	2	-67	358	92
CW	208	566	30	51	178	7	-76	388	63
FG	85	991	275	-571	971	351	81	19	29
CH	143	1000	386	478	817	413	226	183	386
FEL	66	1000	216	-505	748	212	293	251	297
DU	66	774	28	81	147	5	-167	628	97
CR	50	781	17	119	400	9	-116	381	36

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Appendix 2a: Eigenvalue report (Breed & breed characteristic)

Axis	Eigenvalue	Individual	Cumulative
1	0.142192	54.9	54.9
2	0.061609	23.8	78.6
3	0.038508	14.9	93.5
4	0.009719	3.8	97.5
5	0.005896	2.3	99.5
6	0.001217	0.5	100.0
TRACE	0.25914		

Appendix 2b: Detailed report: Eigenvalue report (Breed & breed characteristic)

Variable	Mass	Quality	Inertia	K=1	Correlation	Contribution	K=2	Correlation	Contribution
Rows									
Fur	2	232	13	-582	223	5	-112	8	0
Availability	4	749	61	-191	10	1	1626	739	189
Mothering ability	201	859	59	-251	831	89	46	28	7
Carcas weight	232	967	237	506	966	417	10	0	0
Offspring	161	668	67	-181	302	37	199	366	104
Pet	68	756	123	-464	463	104	-369	294	152
Other farmers	68	504	57	-295	405	42	-146	100	24
Disease resistance	51	806	63	-179	99	11	-479	707	189
Price	110	928	132	530	903	218	-87	24	14
Foraging ability	9	581	13	-461	550	13	109	31	2
Growth	15	887	92	-303	59	10	1129	828	320
Beauty	77	349	83	-312	349	53	2	0	0
Columns									
NZW	397	630	119	-129	620	135	-28	10	5
CW	219	861	164	-72	27	8	404	835	578
FG	88	971	242	822	953	420	-115	19	19
CH	132	638	73	-185	239	32	-239	399	123
FEL	68	951	205	856	946	353	64	5	5
DU	60	435	141	-254	105	27	-450	330	196
CR	35	574	56	322	255	26	-361	320	75

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