DAILY PERFORMANCE AND LACTATION **CURVE CHARACTERISTICS** OF PURE FRIESIAN CATTLE AT KADAWA DAIRY FARM IN NIGERIA

A Thesis Presented to the Postgraduate School, Ahmadu Bello University, Zaria. In Partial Fulfillment of the Requirements for the Degree of Master of Science

BY

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June, 1992

THESIS APPROVAL

This thesis, entitled "DAIRY PERFORMANCE AND LACTATION CURVE CHARACTERISTICS OF PURE FRIESIAN CATTLE AT KADAWA DAIRY FARM IN NIGERIA by FARUKU, Sa'ad Giginyu, meets the regulations governing the award of the degree of Master of Science of the Ahmadu Bello University, Zaria for its contribution to scientific knowledge and literary presentation.

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DECLARATION

I hereby declare that the work in this thesis was carried out by me in the Department of Animal Science, Ahmadu Bello University, Zaria, under the supervision of Dr. N.I. Dim and Dr. B.Y. Abubakar.

The work is original and has not been submitted in any form to any other University for the award of any degree. Where use has been made of published work of other investigators, this has been duly acknowledged in the appropriate parts of the text and in the list of references at the end of the desertation.

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DEDICATION

TO

Al-Mighty Allah (SWT) and BY His Permission, I extend it to all members of my family who gave maximum assistance through their prayers, love, encouragement and financial support.

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ABSTRACT

A total of 441 lactation records for calvings between 1970 and 1981 were used to evaluate dairy performance and lactation curve characteristics of purebred Friesians. Means and standard errors for 305-day milk, lactation length, calving interval and days dry were 2589 ± 57.38kg, 271± 3.44 days, 484 ± 10.94 days and 131 ± 8 46 days, respectively. Year of calving had a significant effect (P<0.05) on 305-day milk yield and days dry. Milk yield increased with parity and was highest in the 4th and 6th lactations. Milk yield was positively correlated with lactation length, calving interval and days dry. All other phenotypic correlations were negative. Overall Least-squares means for the functions of the lactation curve a, b and c by fitting Wood's model were 2.83, 0.69 and 0.10, respectively. The mean persistency and correlation coefficient of lactations were 2.38 and 0.81, respectively. There is considerable variation, in level of production (a), persistency (s) and correlation coefficient (R^2), due to parity and season of calving. Level of production was highest in the second parity and during the cool dry season (December - February). Persistency was higher in dry season calvers than in Wet season calvers and first parity lactations are the most persistent. Both rate of rise (b) to, and decline (c) from, peak yield decrease with parity. Other parameters do not show any definite trend with parity and season of calving.

CHAPTER ONE

1. GENERAL INTORDUCTION

The Friesian dairy cattle are indigenous to temperate regions but have been imported into tropical and subtropical environments in order to improve milk production in the tropics. This is not unconnected with their high potentials for fast growth, early maturity and high milk yield. The role of the Friesian breed of dairy cattle in improving the dairy production potential in the tropics and the attendant influence of change of environments are clear. Inorder to achieve any improvement in the dairy production potential in the tropical environment knowledge of the performance and the influence of genetic and environmental factors is necessry (Dim 1972). This Knowledge of the performance and the relative influence of genetic and environmental factors is usually obtained by analysing field and/or experimental data. Therefore a study of the performance of temperate Friesian dairy cattle in tropical environment would not only be of academic interest but would also serve the useful purpose of collating all the available information to facilitate further progress in tropical animal breeding and production. The study of production traits is

considered as an important aspect for successful management. It serves as, a guide in the management of the animals for accurate feeding according to yield; a check on the health of the animals as well as a guide on managerial factors such as feeding and milking routine. It provides a background against which errors in management can be detected and rectified. The study of the performance of Friesians will serve as a means of assessing the productive ability of breeding stock and provides the information needed in the breeding of better dairy cattle in the tropics.

There are several studies on the perfromance of Friesian dairy cattle and the influence of year, season, age and parity, lactation length, days dry, calving interval on the production performance (McDowell *et al*, 1976; Akinokun, 1977; Udedibie *et al*, 1985, Mbap, 1985; Abubakar et al, 1987; Gyawu et al, 1988; Bidanel et al , 1989; Morsey et al, 1989; Pedron et al, 1989; Mbap and Ngere, 1989;). However, the number of these reports in tropical Africa in general, and Nigeria in particular, is few. The objectives of the present study are to analyse milk production records of Friesian dairy cattle under a tropical environment at Kadawa Dairy Farm, Kano State, Nigeria,

during the period 1970 to 1981, to (1) determine the influence of environmental factors of year, season, parity, and calving interval on the production traits; (2) To determine and establish the correlation between the production traits and; (3) To investigate the lactation curves characteristics.

CHAPTER TWO

2. GENERAL LITERATURE REVIEW

2.1 FRIESIAN HERD AND THEIR PERFORMANCE IN TROPICAL AND TEMPERATE ENVIRONMENTS.

Although much work has been reported on the performance of Friesian dairy herd in the tropics, there were very few reports on the performance of the Friesian dairy herd in Nigeria. This could be attributed to limited number of importations of the animals into the country. Average milk production of pure Friesians in Nigerian tropical environment is shown in Table 2.1. It seems reasonable to conclude that there is little information on the performance of the Friesians in Nigeria. The milk yield ranged from 1400 to 2900 kg in Nigeria, 2600 - 4700 kg in other African countries, 2200 - 7000 kg in other tropical countries and 3000 - 6700 kg in temperate countries. There seems to be a lot of variability among the Friesians in Nigeria in terms of milk production. Age at first calving and calving interval were normal in Nigeria with regard to other tropical countries. The average milk production in Ibadan or Western Nigeria is higher than in the North despite Tsetsefly in the South and this may be due to shortage of or irregular feed supply and higher temperatures in the North.

The average milk production per lactation of the pure Friesian dairy cattle in other tropical African countries is shown in Table 2.1. The result of studies on the performance of pure Friesians in tropical African countries seems to indicate that there is a lot of variability among the Friesians in terms of milk yield, lactation length, calving interval, days dry and other performance traits. This could be due to differences in local climate, management and feeding factors. The production traits are affected by among other factors farm location, farm management, year, season and lactation length. Imported heifers generally seems to be superior to imported foetuses and locally born heifers in terms of age at first calving, milk yield and lactation length. Studies on the performance of Friesians have been reported, apart from tropical African countries, in serval other tropical and subtropical regions of the World. The average milk yield of the Friesians in other tropical and subtropical region of the World is shown also in Table 2.1. The milk yield ranged frm 2800 - 4800 kg in Middle East Countries, 2800 - 4400 kg for Asian Countries and 2300 - 7000 for South America.

Studies on the performance of the Friesians in the temperate regions have been reported extensively in the

literature. The average milk production per lactation of Friesians in their home (temperate regions) is shown in Table 2.1. There seems to be a lot of variation in the milk yield of the Friesians even in their home - temperate environments. The milk yield ranged from 3425 kg to 6758kg per lactation and increases with lactation number. As can be seen from the table, the milk yield is much higher in the temperate environment than in the tropics especially Tropical Africa.

Table 2.1 Average milk production (Kg/lactation) in tropical and temperate environments for pure Friesian dairy cattle.

Authors	Country/Location	Milk Production (Kg/Lactation)
A. Tropical and Subtropical environments		
I. Nigeria.		
Mbap (1985)	Ibadan	2262
Mbap and Ngere (1989)	Ibadan	2893
Akinokun (1977)	Lagos	2621
Adeneye and Adebanjo (1978)	West. Nigeria	2012
Olayiwole et al. (1973)	Shika	2289
Knudsen and Sohael (1970)	Vom	1394
Nig. Federal Dept. Vet. Res.(1978)	Vom	2351
Udedibie et al. (1983)	Vom	2060

Table 2.1 Average milk production (Kg/lactation) in tropical and temperate environments for pure Friesian dairy cattle.(Continued).

Authors	Country/Location	Milk Production (Kg/Lactation)
II Other African Countries		
Mekonnen (1983)	Ethiopia	4238
Gyawu et al (1988)	Ghana	4683
		2650
Mwandotto(1980)	Kenya	2597
Morsy et al (1989)	Libya	3490
Bradly (1978)	Morocco	2976
Boujenane and Ba (1986)	Morocco	3345
Albero (1980)	Mozambique	3249
Micheals et al (1982)	Tunisia	4145
		3525

Table 2.1 Average milk production (Kg/lactation) in tropical and temperate environments for pure Friesian dairy cattle (Continued).

Authors	Country/Location	Number	Milk Production (Kg/Lactation)
III Other regions			
Cetagen (1978)	Turkey		2808
Fisteag and Lungulescu (1981)	Israel		4796
Ma'arof and Tahir (1988)	Iraq		3400
Bhatt et al. (1978)	India		4463
			3045
Mustapha (1985)	Malaysia		2775
McIntyre (1971)	Fiji		2964
Hoz and Rosemberg (1978)	Peru		3400
Vaccaro et al. (1980)	Peru		4650
Wilkins et al. (1979)	Bolivia		3040

Table 2.1 Average milk production (Kg/lactation) in tropical and temperate environments for pure Friesian dairy cattle (Continued).

Authors	Country/Location	Milk Production (Kg/Lactation)
Ribas et al. (1980)	Cuba	3554
Ramirez and Martinez (1980)	Venezuela	3950
Vaccaro et al. (1985)	Venezuela	2419
Madalena et al. (1983)	Brazil	4149
Abubakar et al. (1987)	Mexico	7082
	Colombia	5071
IV. Temperate environments.		
Zakhariev (1981	Bulgaria	4521
UK, UK (1979)	England	5249
	Scotland	5056
UK, E - W. MMB (1982)	England	5606

Table 2.1 Average milk production (Kg/lactation) in tropical and temperate environments for pure Friesian dairy cattle (Continued).

Authors	Country/Location	Milk Production (Kg/Lactation)
Bidanel et al. (1989)	France	3425
Herz et al. (1979)	GFR	5504
Bodo et al. (1980)	Hungary	6398
Janella et al.(1986)	Italy	5467
Fisteag et al. (1980)	Romania	4506
Bratt (1980)	Sweden	6175
Hinks (1979)	UK (1959)	3954
	UK (1978)	5346
Nedava (1980)	Ukraine (USSR)	6758
Cobic et al. (1981)	Yugoslavia	5026

2.2 FACTORS AFFECTING PRODUCTION PERFORMANCE OF FRIESIANS.

2.2. 1 Effect of year.

Year effects have been observed by many authors to be one of the causes of variations in the production performance of dairy cattle in both tropical and temperate regions. Gacula Jr. et al. (1968) reported that year difference accounted for about 1% of the variation in milk yield with an upward trend attributed in part to genetic selection and in part to improvement in feed and management. Papajcsik and Bodero (1986) found that for Holstein- Friesian in Australia, the percentage of the total variation in lactation milk yield explained by year of calving were 5.0%, 1.0% and 12.0% for the high- , medium- and low - yielding herds, respectively. Bradly (1978) found year of importation to have significant effect on milk yield of Friesians imported into Morocco. Siqueira et al. (1985) observed that for Holstein - Friesians in Brazil during 1965 - 1977, both milk yield and fat yield were significantly affected by year of calving and yields flunctuated from year to year. Alim (1978) attributed variations between years to differences in climatic conditions, feeding and management as well as in the average genetic composition of the population.

Canon (1989) reported that for Friesians in Spain during 1980 - 86, the 305 - day milk yield was significantly affected by year of calving and that there were significant year of calving x geopraphical location interaction on milk yield (PLO.01). Madalena et al. (1983) found year of calving to have significant effect on calving interval and milk yeild. Pedron et al. (1989) reported that for Italian Holstein - Friesian heifers year of birth was one of the important sources of variation in calving interval; cows born between 1979 and 1981 had shorter calving intervals than cows born at other times, probably resulting from the National plan against cattle infertility initiated in the country in 1981. Lindstron and Solbu (1978), Panic (1979), Ribas et al. (1978), Neiva et al. (1979), Ramirez and Martinez (1980), Al - Rawi and Said (1980), Morsy et al. (1989) and Javanovac et al. (1989) all reported significant effects of year on production traits of Friesian dairy cattle.

Therefore it seems reasonable to conclude that year has a significant effect on the performance of Friesian cattle in tropical environment. However, this effect of year is influenced to a greater extent

by climatic conditions, feeding and management and average genetic composition of the population.

2.2.2 Effect of season.

Seasonal variation in the performance of Friesian cattle have been reported extensively in the literature. The magnitude of the estimates varies greatly according to the method of age adjustment (Dim, 1972). Becerril et al. (1981), Suzuki et al. (1983), Mekonnen (1983) and Abubakar (1983) observed that Friesian dairy cows calving in the cooler months had greater milk production than cows calving in the warmer months of the year. Similar observations were made by Siqueira et al. (1985), Canon (1989) and Ohashi et al. (1987). However Ribas et al. (1980), Al-Ashmawy (1981) and Morsy et al. (1989) found no significant effect of season. On the other hand, Dim (1972) reported that Van Vleck et al. (1961) observed season of calving to account for 2% of the variation in milk and butter fat yield, Gacula Jr. et al. (1968) found 1.9% for milk yield and 1.4% for fat content, Wood (1970) observed 12% for milk yield and Syrstad (1966) found 4% for the mean squares for the same traits. He concluded that the seasonal effects account for about 2% of the variation in milk yield while the

effect on butter fat content was insignificant. Roman Ponce et al. (1978) reported that month of calving accounted for 3.4% of variation in milk yield. Skjervold (1979) found that milk yeld during the most unfavourable months (April - June) was 78 - 86% of those during the best months (August - January). Russell (1980) observed about 11% differences in favour of October calving compared to June calving. Matsuo et al. (1982) reported that seasonality of total milk yield by month covered a range of 16.6% from April (+7.7%) to August (-8.9%) and the total milk yields of summer calvers were about 1000kg lower than those of spring or autumn calvers.

Zamorano (1986) reported that persistency of milk yield in the first lactation averaged 70% for cows calving in April - September and 77% for those calving in October - March compared with 59% and 60%, respectively for cows in their 5th Lactation. Madalena (1979) found that cows calving during the rainy season had higher initial milk yield than those calving in dry season but persistency was higher in the dry season calvers. Similar observations were made by Bidanel et al. (1989). However, Abubakar (1985) reported that Holstein - Friesian cows calving in the wet months had lower milk yields than those

calving in the dry months. Napolitano et al. (1987) found that fixed effects of month of calving was significant (PLO.01) source of variation in calving interval with repeatability value of 0.145 for calving Interval and that cows calving in July had the shortest calving interval. Djemali et al. (1989) also found month of calving to be significant for calving interval between first and second lactations (383 days) and second and later lactations (380 days).

According to Remond and Vermerel (1982), effects of climatic factors of seasonal variations in the milk yield and composition are of less importance in temperate countries because they tend not to be severe as a result of adaptation of these effects by the animals and also because management practices remove some of their effects. Thanindratarn (1978) observed that for temperate zones a decrease in milk yield caused by adverse weather was usually followed by a few days of higher, compensatory production and combination of weather factors, such as rainfall, temperature and wind speed, were more important than single factors. Abubakar (1983) attaributed seasonal differences in dairy cattle performance to rainfall patterns. He also reported (Abubakar, 1985) that changes in temperature

and humidity acted directly on the homeostatic mechanisms of the animal and brought about adjustments in behaviour which in turns affected production. There is also the indirect effect of seasonal variations on forage quantity and quality.

From above review it can be concluded that season has significant effect on the production performance of dairy cattle. The effect varies with the local climatic factors. Cooler months are more favourable to milk production than warmer months. The effect of seasonal variations seems to be more important and devastating in tropical than in temperate environments.

2.2.3 Effect of parity.

Age is one of the main factors affecting yield and in dairy cattle the age effect can be based on recording year or lactation number, (Dim, 1972). Dim (1977) also observed that milk production increased with age at a decreasing rate and reaches a maximum when cows were about six years old and decreased as cows get older. Abubakar (1983) reported that it had been established that milk production increases with maturity of the cows and then slowly decreased. The rate of maturity, according to Dim (1977) depends on a

number of physiological factors; and this is affected by both heridity and environment. It is, therefore, likely that the yield - age relationship differs from one animal to another. Mahadevan (1958) reported that whereas European cattle in their home environment attain peak production by the fifth lactation, the time of maximum productivity in the tropics is about the third or fourth lactation. This he observed was probably due to the late age at first calving (40 months) and the long calving intervals (466 days) than in temperate regions. However, Mahadevan (1956) found that for intensively selected European cattle in Ceylon(Sri Lanka), a tropical country, increases in yield with age were comparable with those obtained in Europe. Ngere and Robertson (1987) observed that in the tropical cattle, age was significantly related to total lactation yield (P<0.05) although it contributed less to variability than reported for temperate breeds. This may also hold for even the temperate breeds imported into the tropics.

The effect of parity on both milk yield and fat yield has been reported by Lindstron and Solbu (1978); Ribas et al. (1980), Arimura (1982) and Rorato et al (1985). Dim (1972) concluded that age accounted for about 15% of the variance in milk yield, with heifers which calved at about the age of three years producing

70% of what the mature cow produce. Cowan et al. (1981) also observed that milk yield was greater for cows than heifers (PL0.001) in Friesians. Abubakar (1985) found that for Holstein - Friesian in Mexico, young cows milked longer, had fewer days dry, short calving intervals and carried calves longer days than older cows. Papajcsik and Bodero (1986) reported that the percentage of the total variation in lactation milk yield explained by age of the cow for high - medium and low - yielding cows were 17, 16 and 1.0%, respectively. Canon (1989) reported very significant effect of age of cow on lactation milk yield for Friesians (PL0.01). He also found significant age of cow x geographical location interaction on milk yield. Javanovac et al. (1989) also reported significant influence of age on milk yield for Holstein - Friesians in Yugoslavia.

The effect of parity on milk yield only was found by Madalena (1979), El-Ghandour et al. (1979), Matsuo et al. (1982) and Zamorano (1986). Ribas et al. (1978) reported effect of parity on fat percentage and lacatation length. On the other hand, Adeneye and Adebanjo (1978) reported that linear and quardratic contrast of lactation number for imported British Friesian cattle in Western Nigeria, were non-

significant for milk yield. Neiva et al. (1979) also found no significant effect of parity on milk yield or fat percentage. Madelena, et al. (1983) reported that for Holstein - Friesians in Brazil, neither genotype nor parity had a significant effect on lactation milk yield, lactation length and calving interval, but there was a significant genotype x parity interaction for milk yield.

From the above accounts it can be concluded that generally parity has a significant effect on the performance of Friesian dairy cattle; milk yield increases with parity up to a maximum production after which it decreases. Peak production is achieved in tropical environment at lower parity than in temperate environment.

2.2.4 Effect of Lactation Length.

Much has been reported on the effect of lactation length on the performance of the Friesians in both tropical and their home-temperate environments. Bradly (1978), Oldenbroek (1978), Ramirez and Martinez (1978) and Rorato et al. (1985) all reported significant effects of lactation length on milk yield of Friesian and Holstein - Friesian dairy cattle. Neiva et al. (1979) found that for Holstein - Friesians in Brazil lactation length averaged 301.18 + 61.44 days;

accounted for 41.5% of the total variation in milk yield and there was a significant interaction between lactation length and parity. Papajcsik and Bodero (1986) observed that for Friesian cows in Australia, the percentage of the total variation in milk yield explained by lactation length was 44%, 26% and 20% for high-, medium-, and low- yielding herds, respectively. Ribas et al. (1980) reported that for Holstein - Friesians imported into Cuba from Canada and those born locally, lactation length had a significant effect on fat yield and calving interval and there were no significant differences between the imported and locally born cows, except for gestation length.

On the other hand, Freeden et al. (1982) reported that for Holstein - Friesians in Canada high production was associated with short lactations and that lactation length had a strong negative influence on average daily milk yield. Lizana et al. (1985) also observed that for European Friesians and Holstein Friesians in Chile lactation length was not significantly correlated with age at first calving, milk yield, year and season of calving.

It seems reasonable to conclude that the lactation length has a significant influence on the

production performance of Friesians. Variability in lactation length is less in temperate than in the tropics. This may be attributed to the harsh climate in the tropical regions coupled with the poor feeding and management systems.

2.2.5 Effect of calving interval.

Calving interval can be defined as the period between two consecutive calvings. It may be divided into the period between calving and conception (service period) and the period of gestation. The period of gestation in dairy cattle, is usually about 282 to 283 days with a standard deviation of about five days for individual gestations (Mahadevan, 1958). Therefore, since the gestation length shows little variation the service period bears the same relation to milk production as the calving interval.

The calving interval has been reported by many authors to exert a pronounced influence on the milk yield. Calving interval is a good measure of reporductive performance which in turn affects milk production (Abubakar, 1983). Mahadevan (1951) reported that an increase in length of the preceeding calving interval contributed materially to an increase in yield in the

current lactation and that the optimum length of calving interval on the basis of the highest average daily yield during successive lactations was about 400 days- for the first lactation and one year for subsequent lactations. He also showed that cows on a high level of production increase their yield with increase in length of preceeding calving interval, proportionately more than low producers. However, from the economic point of view, it would not be profitable to prolong the calving interval excessively. Mahadevan (1958) found that length of calving interval and age at first calving were largely responsible for determining the lactation of maximum productivity in the tropics irrespective of whether the cattle were tropical or temperate in origin.

According to Heinman (1976) in young cows the longer the first calving interval the higher was the milk yield in the first and second lactations combined. In cows, annual milk yields fell by approximately 3 kg for each additional day of calving interval. However, half this loss was compensated for by additional yields in the succeeding lactation. Heinman (1976) also found that in high yielding herd, cows with good persistency and longer calving

intervals were economically superior to those with short calving intervals and poor persistency. Leroy et al. (1978) reported that the relationship of calving interval with 305-day milk yield, fat yield and percentage were curvilinear and that calving interval x herd level of production interaction was significant for milk and fat yields. Sznajder and Majtas (1978) observed a mean length of calving interval of 377 days (range, 277 - 821 days) and a coefficient of variation of 14.8% for Holstein - Friesians in Poland. Bourchier (1981) found that as calving interval decreased from 350 to less than 330 days the subsequent lactation yield decreased (P<0.05) by 822 Kg. Freeden et al. (1982) observed that for Holstein- Friesian in Canada high production was associated with shorter calving intervals and that average calving interval adversely affected average daily milk yield. Udedibie et al. (1983) reported an average calving interval of 368 and 335 days for 87 imported and 13 Vom-bred Friesians, respectively. This compares favourably with the 367 days earlier recorded by Knudsen and Sohael (1970) for the first imported Friesians at Vom, Nigeria.

Abubakar (1983) reported that a possible reason for long calving interval among Holstein-Friesian herd in

Mexico could be that there was a shortage of adequately trained Artificial insemination (A.I.) personnel to handle a sudden large influx of herds into a programme. Bourchier et al. (1987) observed that given adequate nutrition and sound reproductive management, high-yielding dairy cows can achieve calving intervals of 365 - 385 days. However, according to Napolitano De Farais et al. (1987) fixed effects of year and month of calving, herd, lactation number and yield were found to be very significant (P<0.01) sources of variations for calving interval. They observed that July had the least calving interval and concluded that yield, herd and month of calving we the most important factors affecting calving interval and lactation number the least important. Pedron et al. (1989) also found that the factors; herd, year of birth, month of calving and milk yield were important sources of variation in calving interval and there was a positive correlation between calving interval and milk yeild. Analysing data for three or more lactations from the records of large pedigree Friesian/Holstein - Friesian herd in South Wales and the South - east of England, Brother-stone (1987) observed that his mean previous calving

interval of 381.3 days agrees closely with the value of 382 days quoated by Wood (1980) in a survey of the effects of previous calving interval. He also reported that as expected, there was a very highly significant correlation of 0.399 between previous calving interval and previous days dry (P<0.001), and 0.466 between subsequent calving interval and subsequent days dry. Significant effect of calving interval on milk yield was also reported for Holstein - Friesians by Javanovac et al. (1989).

From the above accounts it could be concluded that calving interval has a significant effect on, and a positive correlation with, milk yield of Friesians in both temperate and tropical environments. The optimum length of calving interval would be about 380 days. Important factors affecting calving interval are nutritional and reproductive management, herd, year of birth, month, season of calving and days dry.

2.2.6 Effect of days dry

Days dry or dry peirod is the difference between calving interval and lactation length. Fitting both days dry and calving interval results in a prediction of lactation length which is highly correlated with

yield (Brotherstone, 1987). McIntyre (1971) reported that length of the dry period and age at first calving appeared to be the factors limiting productivity of Friesian cattle in a tropical environment of Fiji. Medina cruz (1979) found that for Holstein - Friesian in central, southern and Northern Mexico, length of dry period averaged 70 days and had a significant effect on milk yield in the folowing lactation. The optimum length of dry period was 57 days. Russell (1980) observed that a very short dry period tended to depress the following lactation yield, the optimum dry period would appear to be about 50 - 60 days and, that a longer dry period might give a higher subsequent lactation yield. Analysing Dairy Herd Improvement record (DHI) for 8981 Holstein - Friesian, Dras and Allaire (1982) reported that length of dry period accounted for 2.8% of the variation in daily milk yield in the subsequent lactation. The length of the dry period to maximum daily milk yield over two lactations (preceeding and following) decreased on average from 65 to 23 days as age at preceeding calving increased from 24 to 83 months. They also found that cows with calving interval greater than 365 days required less days dry than cows with shorter calving intervals; cows with calving interval less

than 360 days required at least 55 days dry and that cows yielding above 19kg of milk 100 days before calving needed more days dry than cows yielding less.

Cabello et al. (1980) reported that for Holstein-Friesian in Mexico the dry period averaged 70 + 0.398 days and had a significant effect on milk yield in the next lactation. The highest yield was obtained from cows with a dry period of 57 days and the lowest from cows with a dry periods of less than 40 days or above 75 days. Roman Ponce et al. (1982) observed that for 336 Holstein Friesian heifers calving during 1971 - 1976 in Havana, Cuba, dry period was not significantly related to production traits except milk yield or calving interval but was more related to reproductive traits. Alzate et al. (1987) observed that for 281 Holstein-Friesian cows in Colombia, medium-sized cows had longer dry and open periods than large - or small-sized cows. According to Brotherstone (1987) days dry was genetically correlated with milk yield and because of this and the inability to determine whether an animal dried-off naturally or was dried - off due to a management decision correcting records for days dry is not recommended. He also found that days dry was also highly correlated with calving interval which had not been found to be genetically correlated with yield.

In all his analysis, days dry and calving interval fitted as linear regression were found to remove a substantial proportion of the variances and were in all cases significant. Djemali et al. (1989) reported that for North American Friesians the optimum number of days dry for subsequent lactation yield was between 63 and 84 days.

It seems reasonable to conclude that days dry has a significant and similar effects on subsequent lactation milk yields of Friesian cattle, in both tropical and temperate environments. The optimum days dry would be about 60 - 80 days.

2.2.7 Effect of other Factors.

The effects of several other factors on the performance of Friesian have been reported, extensively in the literature, for both temperate and tropical environments. Dim (1972) reported that herd effects have been observed by many authors to be the cause of large variation in milk yield and several authors have estimated the percentage of the variation caused by differences between herds. He concluded that herd effect accounted for a fairly large amount of the variation and that it was possible to remove a fair amount of this herd effect by expressing records as

deviations from herd means. Jara Almonte and White (1972), Camoens et al. (1976a, 1976b), Lee (1974) and McDowell et al. (1976b) found significant effects of herd on milk yield. Cooper and Hargrove (1982) observed that herd effect accounted for 26.7% of the variation in milk yield when effects of age at first calving and month of calving were removed.

Bradly (1978) reported that farm region and farm management conditions had significant effect on milk yield of Friesian cattle in Morocco. This agrees with the findings of Javanovac et al. (1989). Duranti et al. (1978) found significant differences between Italian Friesians on hill and lowland farms for milk yield (4146 vs 5508 Kg, respectively) and concluded that dairy farming should be concentrated in the lowlands. However, this does not apply to Nigeria when we compare the average milk yield at Ibadan with that at Vom or Shika.

Temperature and relative humidity have also been reported as factors affecting production performance of Friesians. Jara Almonte and White (1972) observed that humidity and sunshine had little effect on milk yield and fat percentage whereas temperature had a significant effect on the milk yield but not on fat percentage. Feng (1982) found that Holsteins in China

were adversely affected by high temperatures from April - August during which milk yield decrease by 35%. Perez-Beato (1982) reported that for Holstein - Friesians in the first and second lactation in Cuba, rainfall had a significant effect on milk yield in the second lactation but air temperature and relative humidity did not affect yields in either lactations. However, according to Rewond and Vermer el al. (1982), in temperate countries the effects of climatic factors on seasonal variation in the milk yield and composition were of less importance because they tended not to be severe and because they can be adapted to by the animals and allowed for in husbandry methods. Mukai (1973) reported that decline in the production of dairy cows during the hot weather could be prevented by cooling the barn with well water or by blowing relatively cool air into the shed, mist-spraying the animals with water or blowing air directly over them, and replacement of roughage by concentrates to depress the fibre content of the feed. Kamal et al. (1989) also reported that the adverse effects of temperature on milk yield could be checked by cooling treatment of heat stressed lactating cows using cool drinking water.

Level of feeding and feed quantity and quality have also been reported to greatly influence milk production. Waheed et al. (1977) reported that feed

and management factors are likely causes of a major portion of herd differences in milk yield and variance due to herd was reduced to 22% from 37% by elliminating feed and management effects. UK West of Scotland Agric. College (1980) reported that the level of Dry matter feeding during lactation and during the dry period had a significant effect on milk yield during subsequent lactation. Stout and Jafri (1980) observed that the most influential environmental factor affecting milk production was feed quantity and quality. Dragovicks (1979) reported that reduction in digestibility and palatability of grasses during late summer appeared to be of greater importance in influencing production patterns of Friesian cows than the direct effect of stressful temperature - humidity conditions on the cows.

Other factors observed to have influence on performance of Friesians were general health and welfare of the cow, lack of excercise and undue excitement (Russell, 1980); size of the animal, with medium-sized cows having higher 305-day milk yield and longer dry and open periods (Alzate et al., 1987). Furniss et al. (1988) also reported that milk yield and calving interval were significantly greater for

2.3 SOME CORRELATIONS AMONG PERFORMANCE TRAITS OF FRIESIANS.

Significant correlation among the production traits of Friesian cattle, in both tropical and temperate environments, have been reported by several authors. Some correlations among the production traits of the Friesians is shown in Table 2.2. However, Lizana et al. (1985) reported that for European Fiesian and Holstein - Friesian cows in Chile lactation length was not significantly genetically correlated with milk yield, year and season of calving, and age at first calving. Cobic et al. (1981) also found that for Friesians in Yugoslavia the genetic correlations of dry period with lactation length, milk yield and calving interval, were mostly non-significant. This agrees with the findings of Abubakar (1985) for Holstein - Friesian in Mexico. On the other hand, Brotherstone (1987) reported that days

Table 2.2 Estimate of some correlations among production traits of pure Friesian dairy cattle.

Authors	Country	Traits correlated	Correlation Coefficient
Vaccaro et al (1980)	Peru	Milk yield and Lact. Length	0.43
Ribas et al. (1980)	Cuba	Milk yield and Lact. Length	0.51
Valle et al (1980)		Milk yield and Lact. Length	0.60
Roman Ponce et al (1978)		Milk yield and Lact. length	0.67
Alim (1978)		Milk yield and lact. length	0.75
Becerrile et al.(1981)		Milk yield and lact. length	0.84
		Milk yield and C.I.	0.16
Ribas et al. (1980)	Cuba	Milk yield and C.I.	0.28
Alim (1978)		Milk yield and C.I.	0.30
Roman Ponce et al. (1978)		Milk yield and days dry	0.21
Saveli (1979)		Milk yield and days dry	-0.30
Becerril et al. (1981)		C.I. and days dry	0.16
		C.I. and lact. length	0.30

dry is highly genetically correlated with calving interval, which according to him, has not been found to be genetically correlated with yield.

Some correlations between persistency and other production traits have also been observed. Matsuo et al. (1982) observed that peak milk yield tended to increase with increasing parity and total milk yield was significantly genetically correlated with persistency (0.32). Caetano et al. (1982) reported that for Canadian Holstein - Friesian and British Friesian cows, on the whole, the genetic correlation of milk yield in the second lactation with that in the first was 0.58 ± 0.11 and that between persistency of yield in the second lactation was 0.06 ± 0.18. They also reported that the genetic correlation of milk yield with persistency was 0.84 ± 0.08 and 0.21 ± 0.13 in the first and second lactations, respectively.

2.4 LACTATION CURVES AND PERSISTENCY IN FREISIANS.

Several attempts have been made to describe the variation in milk yield during the course of lactation in dairy cattle, this variation is usually described by the lactation curves (Abubakar and Buvanendran, 1981). The shape of the lactation curve, which determines persistency, is an important factor in the economics of milk production (Ibeawuchi, 1984). According to Abubakar and Buvanendran (1981) studies

on the lactation curves are useful in enabling the farmer to predict the course of lactation in his animals and to make decisions on the quantity of supplementary concentrates that he needs to purchase. They are also useful to researchers experimenting with lactating animals in choosing relatively uniform animals.

The shapes of the lactation curves are typically characterized by two segments - the rising segment and the declining segment. On the average the rising segment does not extend for more than 10 weeks from the date of calving and there-after there is a decline in production which may be very rapid in some cows and slow in others. Cows which show a very rapid decline in production are said to be non-persistant while those which show a slow decline are termed persistent cows. The persistency, then, is a measure of the shape of the lactation curve and it determines the degree to which the milk yield in early lactation is maintained by a cow during the rest of her lactation. Adeneye and Adebanjo (1978) defined persistency as the monthly milk yield expressed as a percentage of the yield in the previous month.

Several researchers have reported on the lactation curves and persistency in dairy cattle in temperate

regions but little is known from the tropics. Singh and Mishra (1980)reported a significant effect of season of calving on persistency; the highest persistency was attained by summer calvers, while the lowest was found in cows that calved in the winter months. This is contrary to the findings of Mahadevan (1951) who observed that the winter calvers were more persistent than summer calvers. On the other hand, Sexena and Kumar (1960) did not observe any relationship between persistency and season of calving. Madalena et al. (1979) reported that for Holstein - Friesian cows, persistency was higher in dry season calvers than in wet season calvers. This agrees with the findings of Abubakar and Buvanendran (1981) and Ibeawuchi (1984). Matsuo et al. (1982) observed that milk yield during early lactation was depressed in cows calving in July and August, compared with that of cows calving in other months, and tended to decrease linearly as lactation proceeded, whereas the milk yield of cows calving in spring increased during the first weeks of lactation and declined comparatively slowly as lactation preceeded. Ohashi et al. (1987) reported that shape of lactation curve varied with season of calving; that of winter calvers was normal, but that of spring calvers fell off

rapidly. The lactation curve of summer calvers had a gentle, almost linear slope, but that of autumn calvers was convex. Seasonal variation of persistency in diary cattle were attributed to pervailing conditions of food supply in the different months of the year (Mahadevan, 1951 and Ibeawuchi, 1984). Abubakar (1983) attributed the production suppriority of high - producing herds to their greater persistency.

Parity has also been reported to have some influence on the lactation curve and persistency of dairy cattle. Adeneye and Adebanjo (1978) reported a persistency range of 89.8 to 98.6% in the first five lactations of Friesians and a similar trend for up to the fourth months of lactation. The persistency was 80% or more when using ratio method during the fifth to sixth and 6th - 7th month of the first and fourth lactations, respectively. They also observed that there was no regular trend between persistency and the stage or number of Lactation. Ortiz Martinez (1979) found that for Holstein - Friesian, in Mexico, in the first, second and third lactations persistency was 95, 92 and 90%, respectively and peak yields were obtained on 30 - 60 days of lactation. Shanks (1980) reported

that cows in first lactation had a lower peak yield, slower rate of decline in daily milk yield, higher persistency and took longer to reach peak yields than cows in later lactations. He also reported lower accuracy of fitting the lactation curve in first lactation than in later lactations. Rowlands et al. (1982) observed that peak yields for heifers occurred on average at approximately 10 weeks after calving compared with 7 weeks for cows. Arimura (1982) reported that milk yield was highest in lactations 3 - 4, agreeing with the findings of Abubakar and Buvanendran (1981), 2 - 4 months after calving and in April - May. Abubakar and Buvanendran (1981) also observed that first parity lactations were flatter and also had longer ascending phase compared to other lactations. Zamorano (1986) observed that persistency of milk yield in the first lactation of Holstein-Friesian averaged 70% for cows calving in April - September and 77% for those calving in October - March compared with 59 and 60%, respectively for cows in their 5th lactation. Kozelskii (1982) reported that for 3 herds lactation persistency was genetically correlated with milk yield (0.49, 0.30, and 0.38); calving season (0.67, 0.63 and 0.70) and dry period (0.27, 0.31 and 0.30).

CHAPTER THREE

3. GENERAL MATERIALS AND METHODS.

3.1 The Data and Source.

A description of the data and its source and some of the procedures used for analysis throughout this thesis are presented in this Chapter. The data consitse of 441 lactation records of 96 Friesian dairy cattle imported from the United Kingdom, and their progeny recorded over 12 years from 1970 to 1981 at Kadawa Dairy Unit, Kano State, Nigeria. Kadawa is located in the savanna Zone of West Africa. It is situated at 11^{0} 39" N, $08^{0}.02$" E and at 481.5M above sea level. The climate is characterized by an average annual rainfall of 761mm, over 95 percent of which falls during the rainy season (May to September). The dry season commences with a period of dry cool weather known as "hamattan" lasting from mid-October to February followed by a dry hot weather from mid - February to April. The climate is similar to that of Shika (Buvanendran et al, 1981). Daily temperatures ranged from 10^{0}C to 32^{0}C during the hamattan season and from 17^{0}C to 38^{0} during the hot season. The relative humidity varies from approximately 26 percent during the hamattan to 45 percent during the hot season. The average temperature and relative humidity during the rainy season are 27.5^{0}C and 70.0 percent, respectively.

During the rainy season the cows grazed on unfertilized pastures composed mainly of guinea grass (Panicum maximum) and/or on sown pastures consisting of Digitaria smutsii. This was supplimented by concentrates fed in the milking parlour. The animals were fed silage and given concentrates suppliments during the dry season. In the hot dry weather, cows were usually mist-sprayed with water, and housed in open shades, to reduce the adverse effects of higher temperature. Use of this technique was also reported by Mukai (1973) as one of the ways by which decline in the production of dairy cows, during the hot summer, could be prevented. Fresh water and commercial mineral blocks were available to the animals at all times. Calving in the herd occurred throughout the year and cows were machine milked twice daily. The percentage of records by month of calving is shown in Figure 3.1

3.2 Screening and Analysis.

Milk production were recorded in milk production record books and compiled weekly on the basis of milk weights (evening and morning). From these record books, production

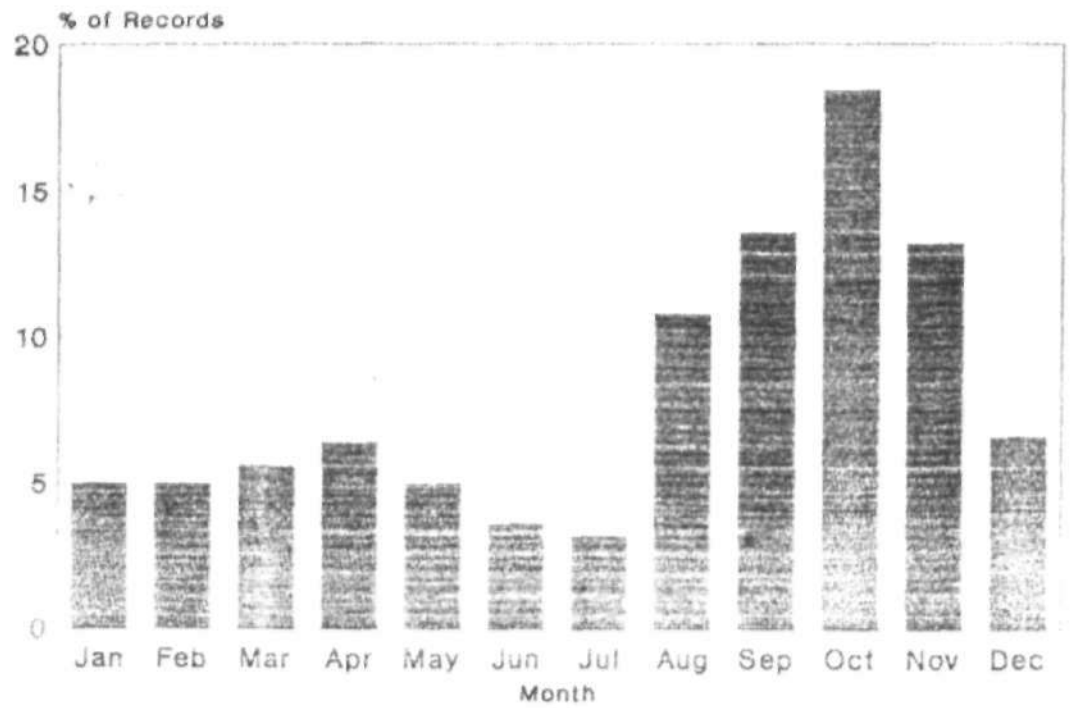


Figure 3.1 Percent of Records by Month of Calving

records of each cow and for the different parities were compiled. The 305 days milk yield was calculated for each lactation. The calving intervals were computed, from the recorded dates of calving, as the difference between two consecutive calvings. The previous days dry were also computed as the difference between the recorded date of drying and the date of subsequent calving.

All lactations subsequent to all birth that occurred between 1970 to 1981 were used for the analysis irrespective of the lactation length. Therefore record of heifers that dried before 305 days were considered normal and they were used as full lactations. This has also been used and reported by Dim (1972) in analysing Friesian production records. Abubakar (1985) reported that although abnormally short lactations lower the correlation of phenotype to genotype, their exclusion is justified only if they are not of genetic origin. In the analysis for effects of season of calving on the production traits, three season of calving were identified; hot dry (February - May); wet (June - September) and cool dry (October - January), as suggested by Oni et al. (1988). The data were analysed for effect of month, year, season and

parity on milk yield, lactation length, calving interval and days dry using Least squares method according to Harvey (1960). The fixed effect model was:

$Y_{ijkl} = U + Yi + Sj + Pk + e_{ijkl}$

where:

Y_{ijkl} = performance variate of Cowe freshening in ith year, jth season and for kth parity,

U = Least - squares mean

Yi = effect of ith year

Sj = effect of jth season

Pk = effect of Kth parity

e_{ijkl} = residual term. The residual term is random error which is assumed to be normally and independently distributed with mean zero and variance = Ve. Simple correlation analysis between performance traits were also carried out.

Lactation curves characteristics.

To provide a description of the lactation curves characteristics mean daily yield of each animal during each week of lactation was computed from the weekly total yield. These data were fitted to the Wood (1967) gamma function:

$$Y = An^{b} e^{-cn}$$

where:

Y = the average daily milk yield (Kg) in the nth

week of lactation

e = base of natural logarithms

A, b and c = are positive parameters which determine the shape of the curve.

The parameters of the Wood's gamma function were estimated after a transformation of the data, by linear least- squares estimation as described by Cobby and LE Du (1978). The logarithmic transformation yields,

$$Log_e Y = Log_e A + bLog_e n - cn.$$

The estimates of $Log_e A$, b and - c were obtained for each lactation by fitting multiple regressions of $Log_e Y$ on $Log_e n$ and n.

The effects of year, season and parity of calving on each of the components of the lactation curve (A, b, c and s) were examined by Least squares analysis according to Harvey (1960). The fixed effect model was:

$$Y_{ijkl} = U + Si + Pj + Yk + e^{ijkl}$$

where,

Y^{ijkl} = the observation on the eth animal of jth parity in the ith season and Kth year.

U = the Least - squares means.

Si = effect of the ith season (j= 1....,4)

Pj = effect of the jth parity (j=1,....)4)

Yk = effect of the kth year (K=1,...,12)

e^{ijk} = residual term. The residual term is

random error which is assumed to be normally and independently distributed with mean zero and variance = V^e. Four seasons of calving were identified; the cool dry "hamattan" (December-February); hot dry (March - May); Wet (June - August) and the post-rains period (September - November), as suggested by Abubakar and Buvanendran (1981). Parity was classified into five classes of first, second, third, forth and over forth parity for the analysis on effects of parity of calving. The persistencies (ies) were calculated according to Wood (1969) equation:

$$S = - (b + c) \, 1^{n}n$$

These procedures have been used and reported by Abubakar and Buvanendran (1981); Neilson et al, (1983); Ibeawuchi, (1983) and Udedibie et al. (1985); in describing the lactation curves characteristics and persistency of milk yield in dairy cattle.

CHAPTER FOUR

4. DAIRY PERFORMANCE OF PURE FRIESIAN CATTLE AT KADAWA DAIRY FARM IN NIGERIA.

4.1 INTRODUCTION.

The Friesians dairy cattle are indigenous to temperate regions. These animals have been imported into tropical and subtropical environments with the aim of improving milk production.

According to Dim (1972) in order to achieve any imporvement in the dairy production potentials in the tropics, knowlege of the performance and the influence of genetic and environmental factors is necessary. There have been several studies on the performance of the Friesians in the tropics (McDowell et al., 1976; Akinokun., 1977; Mbap., 1985; Abubakar et al., 1987; Gyawu et al., 1988; Morsy et al., 1989; Mbap and Ngere, 1989 e.t.c.). However, the numbers of these reports in tropical Africa in general, and Nigeria in particular are very few. The objectives of this study are to determine the influence of environmental factors on the performance of Friesian cattle in a hot dry environment and to determine and establish the correlations between the performance traits.

4.2. Materials and Methods.

A description of the source of the data and the procedures used for analysis are presented in Chapter three.

4.3 Results and Discussions.

4.3.1 General performance.

Means and standard deviations for several traits are shown in Table 4.1. The least - squares means are shown in Table 4.3. The average 305 - day milk yield by year, month and parity, of calving are shown in Figures 4.1, 4.3 and 4.5, respectively. Figures 4.2, 4.4 and 4.6 give a general idea about the averages of calving interval, days dry and lactation length by year, month and parity of calving, respectively. The average lactation milk yield is about the same as for Friesian Cows in Ibadan (Mbap and Ngere, 1989) and in Morocco (Bradly, 1978). It is higher than for Friesians in Western Nigeria (Adeneye and Adebanjo, 1978); and in Shika - Zaria (Olayiwole et al. 1973). It is, however, lower than for Holstein - Friesians in Tunisia (Micheals, 1982); and in Ethiopia (Mekonnen, 1983). The average 305- day milk yield of 2589 kg is considerably higher than most earlier estimates in Nigeria. The higher milk yields during 1970 - 1973

were mainly from the imported cows, the medium yields during 1974 - 1978 were probably due to the effect of the first progeny of the imported animals while the low yields during 1979 - 1981 were probably due to the low performance of the progeny of the Kadawa - bred Cows. It could be due to deterioration in feeding and management with increase in number of animals through the years. These trends in milk yield with year is shown in Table 4.3 and represented in Figure 4.1 The small difference between length of lactations agrees with observations of Abubakar (1983) that generally European cattle show comparatively little variation in lactation length.

The average calving interval of 484 days compares well with that of Friesian Cows in Lagos (Akinokun, 1977); in Ghana (Gyawu et al. 1988); and in Libya (Morsy et al., 1989). It is longer than values reported for similar animals in Vom (Udedibie et al., 1983);

TABLE 4.1. MEANS ($\bar{X}$) AND STANDARD ERRORS (S.E.) FOR DAIRY TRAITS.

Trait	n	$\bar{X}$	S.E.
Lactation milk yield (Kg)	441	2924	75.31
305-day milk yield (kg)	441	2589	57.38
Lactation length (days)	441	271	3.44
Calving interval (days)	303	484	10.94
Days dry	303	131	8.46

TABLE 4.2 ESTIMATES OF PHENOTYPIC CORRELATIONS FOR DAIRY TRAITS OF PURE FRIESIANS.

Trait	Milk yeild	Lactation Length	Calving interval
Lactation length	0.65***		
Calving interval	- 0.04	- 0.10	
Days dry	- 0.08	- 0.20	0.76***

*** P< 0.001)

Table 4.3 Least-Squares means for 305-day milk yield (milk 305), Lactation length (LLength), calving interval (C.I.) and days dry (DDRY) by year, season and parity of calving.

Effect	Number	Milk 305		LLength		Number	C.I.		DDRY	
		($\bar{x}$)	S.E.	($\bar{x}$)	S.E		($\bar{x}$)	S.E.	($\bar{x}$)	S.E.
Overall	441	2849	451	268	-	303	476	-	127	-
Year										
1970	13	3618	341.00	234	-	-	-	-	-	-
1971	23	3871	24.98	256	17.84	2	268	66.00	49	70.00
1972	35	3671	230.04	277	12.07	25	410	14.10	128	26.30
1973	42	3471	169.15	290	6.29	32	382	13.15	58	16.01
1974	37	2688	208.97	258	12.44	29	339	16.39	76	9.25
1975	22	2936	274.55	265	17.43	17	477	31.04	156	35.50
1976	42	2321	194.15	239	16.70	25	630	63.60	223	46.36
1977	41	2761	184.90	274	13.31	34	570	44.74	206	35.68
1978	39	2596	153.43	283	9.00	23	554	58.16	173	49.17
1979	54	2097	119.88	279	8.46	45	470	18.42	88	12.88
1980	44	1984	104.96	284	6.79	31	506	31.61	121	15.44
1981	49	2171	103.15	270	6.99	40	473	22.76	120	14.06
Season										
Feb.-May	113	2972	111.26	265	7.18	76	507	22.40	155	19.23
Jun.-Sept.	138	2819	102.82	273	5.84	84	466	18.81	123	14.94
Oct.-Jan.	190	2756	88.55	266	5.28	143	456	16.45	103	11.76

Table 4.3 Least-Squares means for 305-day milk yield (milk 305), Lactation length (LLength), calving interval (C.I.) and days dry (DDRY) by year, season and parity of calving. (Continued).

Effect	Number	Milk 305		LLength		Number	C.I.		DDRY	
		$(\bar{x})$	S.E.	$(\bar{x})$	S.E		$(\bar{x})$	S.E.	$(\bar{x})$	S.E.
Parity										
1	138	2365	102.56	273	6.38	-	-	-	-	-
2	106	2755	129.34	262	7.42	106	505	21.89	167	18.02
3	82	2888	119.58	269	6.76	82	498	22.60	152	16.72
4	51	3197	156.95	276	8.53	51	460	21.75	108	11.89
)4	64	3040	145.43	275	7.81	64	448	22.63	81	10.24

in Ibadan (Mbap and Ngere., 1989); in Morocco (Boujennane and Ba, 1986); and in Tunisia (Micheals, 1982). The average days dry of 131 days is about the same as reported by Becerril et al. (1989). It is less than the 167 and 173 days for Friesian in Western Nigeria (Adeneye and Adebanjo, 1978). Avearage days dry is, however, higher than that reported for Friesians elsewhere (Bonjennane and Ba, 1986; Abubakar et al, 1987; and Djemali et al, 1989). The progressive decrease in days dry from the first parity (Table 4.3 and Figure 4.6) is in agreement with Adeneye and Adebanjo (1978). The long average days dry of 131 days is as a result of the long average calving interval of 484 days.

4.3.2 Effects of environmental factors.

Least-squares means and standard errors of the productive traits by year of calving are shown in Table 4.3 and represented in Figures 4.1 and 4.2. Year of calving had a significant effect (P<0.05) on milk yield and is in agreement with findings on similar animals in temperate environments (Canon, 1989; Javanovac et al., 1989) and tropics (Morsy et al., 1989). Mekonnen (1983), however, reported that year had no significant effect on milk yield of Holstein - Friesian in Ethiopia. Year was also found to have

very high significant effect (P<0.001) on calving interval and days dry and is consisent with findings of Mbap and Ngere (1989), Morsy et al. (1989) and Pedron et al. (1989). The variations between years could be due to differences in climatic conditions, feed and management.

The present study observed that among the performance traits in Friesians only days dry is very highly significantly influenced (P<0.001) by season of calving. Mbap and Ngere (1989) and Morsy et al. (1989) found no significant effect of season on all traits. However, Dim (1972), Canon (1989) and Ohashi et al. (1987) found significant effect of season on milk production. The least -squares means for the traits by season are shown in Table 4.3. Lactation yield did not differ significantly between cows calving in the wet and dry seasons and is in agreement with the result of Mbap and Ngere (1989). They explained that it was probably because lactations in Friensian normally span both seasons. However, Abubakar (1985) and Bidanel et al. (1989) reported that Holstein - Friesian cows calving in the wet months had lower average milk yield than those calving in other months. Seasonal differences in dairy performance, were

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attributed to rainfall pattern, changes in temperature and humidity and, forage quality and quantity (Abubakar, 1985).

The very highly significant effect (P<0.001) of parity on milk yield observed in this study compares well with the reports by other authors (Rorato et al., 1985; Zamorano, 1986; Mbap and Ngere, 1989; e.t.c.). The least - squares means are shown in Table 4.3. Figures 4.5 and 4.6 give a general idea about the averages of the production traits by parity of calving. The average milk yield increases with parity, and was highest in 4th and 6th lactations, but declined thereafter. Mahadevan (1958) reported that European cattle in their home environment attain peak production by the fifth lactation. Mbap and Ngere (1989) found that average lactation yield for Friesians tended to increase with increasing parity up to the ninth lactation, and then decreased. The increase in lactation yield with parity is an

indication of age and physiological growth. Parity of calving was also found to have significant effect (P<0.001) on days dry and is in agreement with the reports of Morsy et al (1989).

4.3.3 Phenotypic Correlations

A very highly significant, strong positive, phenotypic correlation (P<0.001) between milk yield and lactation length (Table 4.2) was observed and this is similar to the report of McDowell et al (1976a) and Musi (1981). Negative phenotypic correlation estimates have been reported for Holstein in Mexico (Abubakar et al, 1987). The very highly significant correlation (P<0.001) between days dry and calving interval agrees with findings of Wood (1980) and Brotherstone (1987) in temperate environment. However, it contradicts the findings of Cobic et al (1981) and Abubakar (1985) who reported that the correlation of days dry with lactation length, milk yield and calving interval were mostly non-significant. This could be because the environments are different.

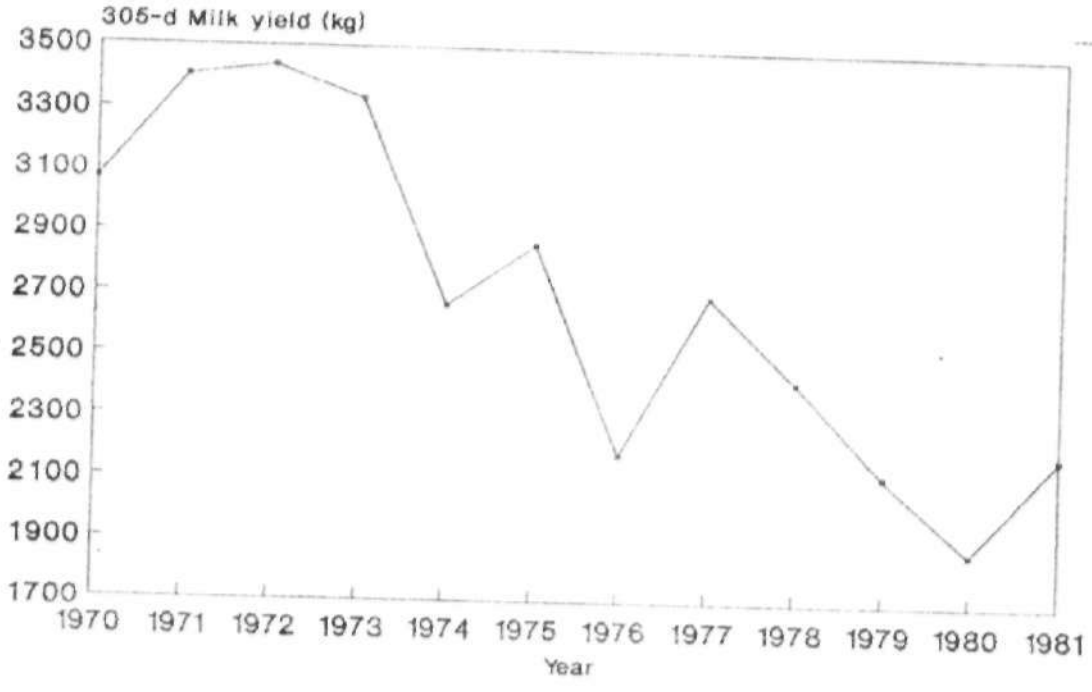


Figure 4.1 Average 305-Day Milk-Yield by Year.

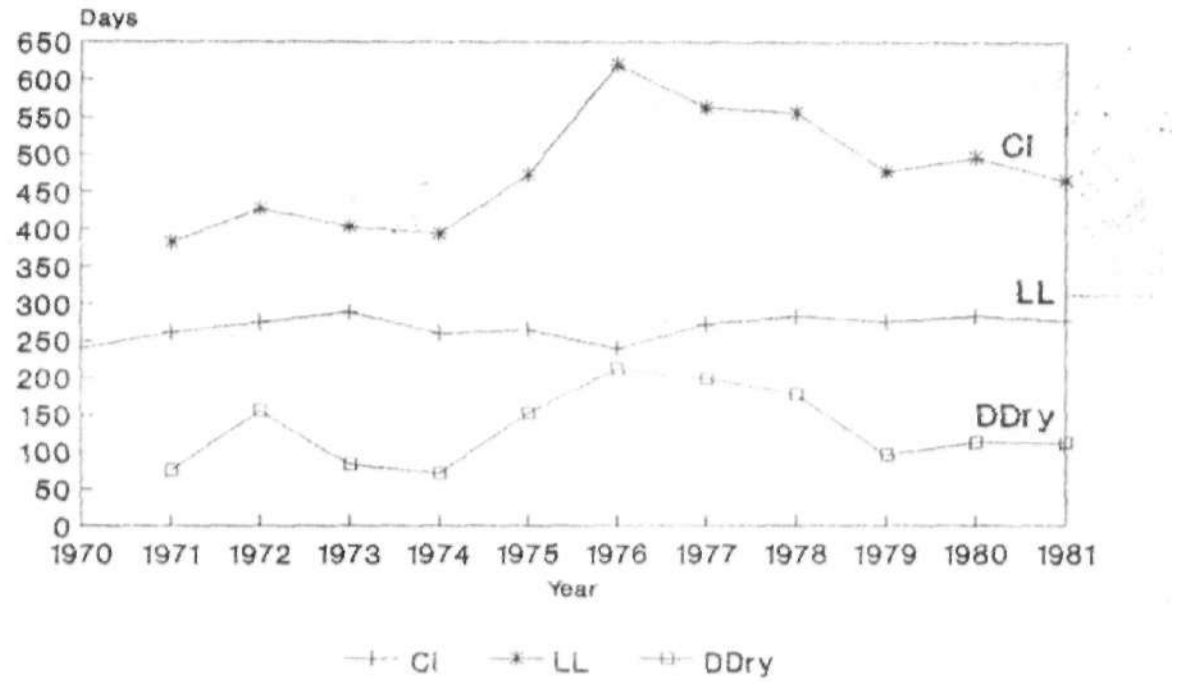


Figure 4.2 Average Calving Interval (CI), Days Dry (DDry) and Lactation Length, by Year

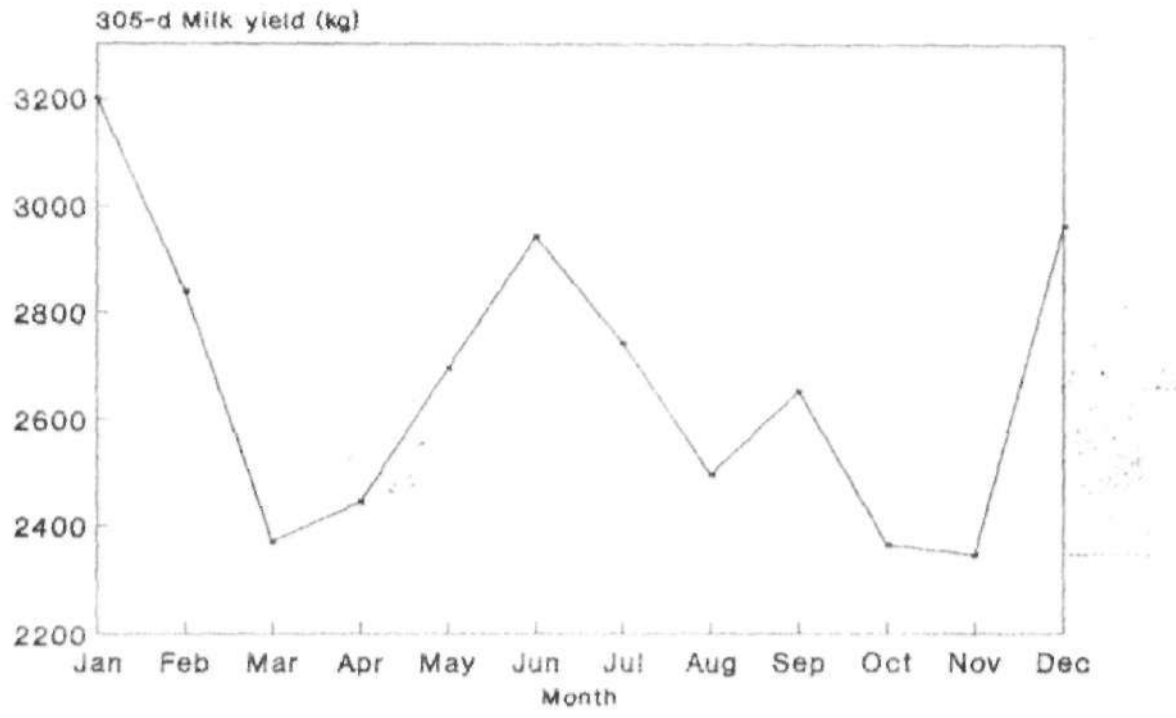


Figure 4.3 Average 305-day Milk yield by month of Calving

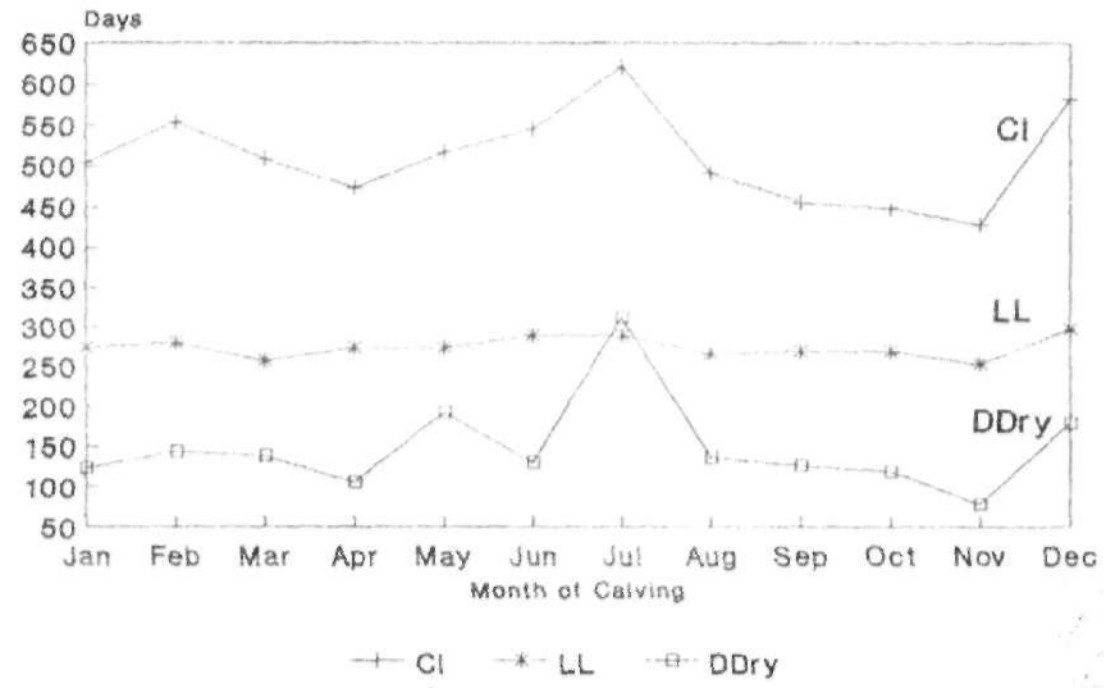


Figure 4.4 Average Calving Interval (CI), Days Dry (DDry) and Lactaion Length (LL), by Month of Calving

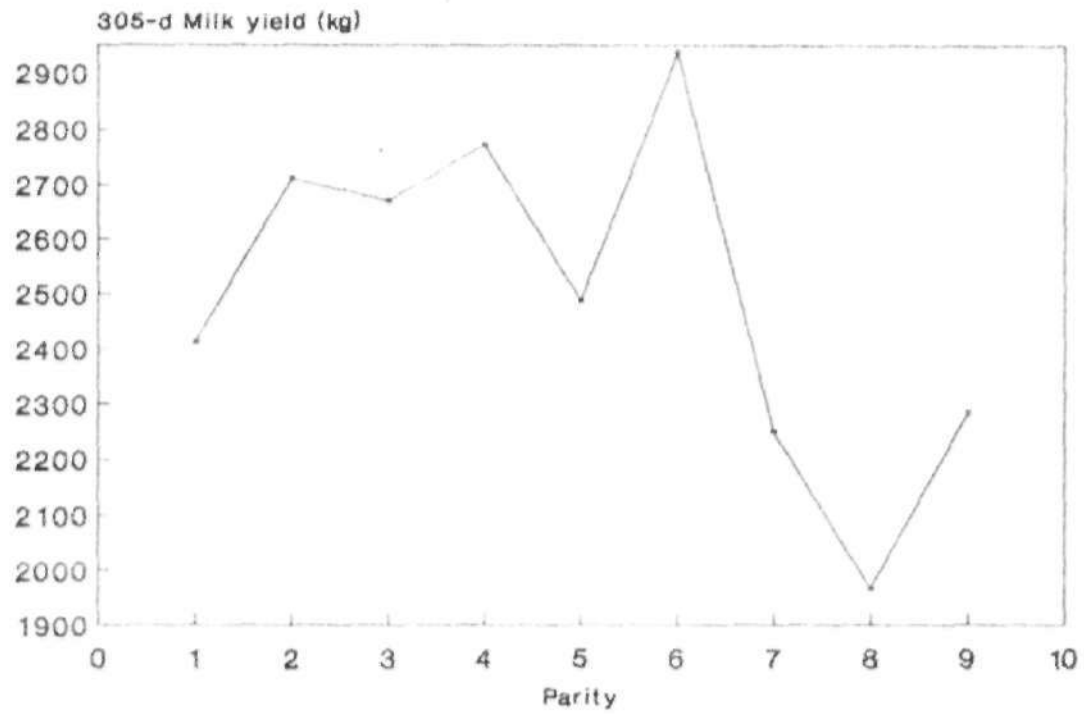


Figure 4.5 Average 305-day milk yield by parity

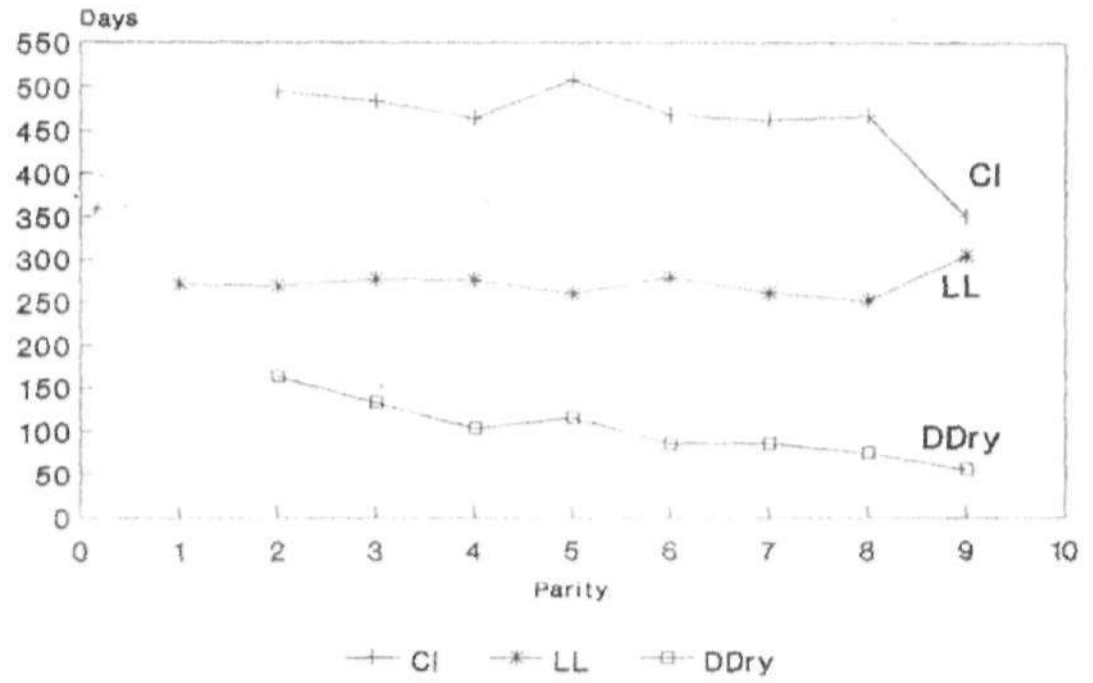


Figure 4.6 Average Calving Interval (CI), Days Dry (DDry) And Lactation Length (LL), by Parity

CHAPTER FIVE

5.0 LACTATION CURVE CHARACTERISTICS OF PURE FRESIAN CATTLE AT KADAWA DAIRY FARM IN NIGERIA.

5.1 Introduction

Several attempts have been made to describe the variations in milk yield during the course of lactation in dairy cattle, this variation is usually described by the lactation curves (Abubakar and Buvanendran, 1981). Studies on the lactation curves would not only help in predicting the course of lactation in dairy cattle but would also shed more light on its characteristics which is an important aspect of milk production. Lactation curve models fitted to lactation data, may be used to summarize an individual animal's lactation and thus the average curves of groups of animals may be compared in terms of the parameters in the model. A curve also provides a mathematical description of average milk yield needed in any simulation model of a dairy enterprice (Cobby and LE Du, 1978).

There are several studies on the lactation curves characteristics and on the influence of season and parity on the lactation curve in dairy cattle in the tropics (Mahadevan, 1951; Adeneye and Adebanjo, 1978;

Madalena et al., 1979; Abubakar and Buvanendran, 1981; Matsuo et al., 1982; Ibeawuchi, 1984; Zamorano, 1986; Ohashi et al., 1987; e.t.c.). However, little information is available about the nature of lactation curves of dairy cattle in Nigerian tropical environment, particularly that of purebred Friesians. The objectives of this study is to investigate the lactation curves chaacteristics of pure Friesian cattle at the tropical environment of Kadawa, Kano State, Nigeria.

5.2 Materials and Methods

A description of the data source and some of the procedures used for analysis are presented in chapter three.

5.3 Results and discussions.

Least-squares means for the functions of the lactation curve (a,b and c), the correlation coefficient (R^2) of lactation curve and actual yields and the persistency (s) are shown in Table 4.4. The mean correlation coefficient over all lactations is 0.81 but there is considerable variation due to parity and season of calving. This value, (0.81), of the mean correlation coefficient over all lactations is lower than the value of 0.84 reported by Abubakar and

Buvanendran (1981) for Friesian - Bunaji crosses in Nigeria. The first - parity lactations show the lowest correlation (0.52) in agreement with findings of Abubakar and Buvanendran (1981). The correlation

Table 4.4 Least-Squares means for the functions of the Lactation curve (a, b and c) by fitting Wood's model.

Classification	a	b	c	Pwk	S	R^2
Overall Lactation	2.83	0.69	0.10	7.39	2.38	0.81
1	2.91	0.53	0.08	8.79	3.31	0.52
2	2.95	0.74	0.11	6.61	2.46	0.81
3	2.81	0.91	0.14	7.00	1.99	0.89
4	2.91	0.94	0.15	6.27	2.06	0.97
>4	2.32	1.13	0.15	8.27	2.07	0.93
Season of calving						
Dec. - Feb	3.01	0.75	0.11	6.48	2.45	0.82
Mar. - May	2.85	0.82	0.12	7.24	2.54	0.77
June. - Aug.	2.57	0.95	0.13	7.71	2.31	0.88
Sept - Nov.	2.69	0.88	0.13	8.11	2.23	0.82

increases with parity up to the fourth parity and decline thereafter. The coefficient was significantly affected by year (P(0.01) of calving only. The highest correlation coefficient of lactations was obtained for lactations commencing during the wet season (June - August) while the lowest was for those commencing during the hot dry season (March - May). Abubakar and Buvanendran (1981) reported similar findings for lactation curves of Friesian - Bunaji crosses in Nigeria, and attributed it to the pasture growth during the wet season which gives a stimulus to milk production and coincides with the peak yield of lactation. The first parity lactations show a slow rise to peak yield (b) and much slower rate of decline (c) resulting in a highest persistency (3.31) of yield. There was a significant effect of year (P(0.05) of calving on rate of rise to the peak while all the other factors with exception of parity had significant effect on the rate of decline from the peak. Both the rate of rise to peak yield (b) and the rate of decline after peak yield increased with parity of calving. Cows that calved between June and August, had significantly (P(0.05) higher rate of decline from the peak when compared to those that calved in other seasons. The

mean general production level over all lactations is 2.83. It is highest for the second parity lactations and lowest for the fifth - and above parity, however, the second parity lactations show faster rate of decline than the first parity lactations. There is no sharp difference in level of production between first parity cows and later calves except for parities after fourth. These features are shown clearly in figure 5.1 which was constructed from the Least - squares means of the respective parities.

First-parity lactations seems flatter and also have a longer ascending phase compared to other lactations resulting in the apparent higher persistency of the first lactations. Abubakar and Buranendran (1981) reported similar findings for Friesian - Bunaji Crosses in Nigeria and similar trend was also observed by Rao and Sundaresan (1979) in Sahiwal Cows, by Wood (1968) in Friesians and by Shanks (1980) in Holstein - Friesians.

The results showed that only the effect of season of calving significantly ($P<0.05$) affected the general level of production. Lactations initiated during the cool dry season (December - February) gave the highest level of production followed by those commencing during

the hot dry season (March - May). This could be due to the higher content of dry matter of the feed as the feeding is more by concentrates during these periods. UK, West of Scotland Agriculture College (1970) reported that the level of dry matter feeding during lactation and during the dry period had a significant effect on milk yield during subsequent lactation. Mekonnen (1983) and Abubakar et al. (1987) observed that Friesians calving in the cooler months had higher milk production than cows calving in the warmer months of the year. This was also observed by Siquira et al. (1985) in Holsteins, Ohashi et al. (1987) in Friesians and Canon (1989) in Friesians. The lowest level of production was obtained for lactations commencing during the wet season (June - August). These features are shown clearly in Figure 5.2 which was constructed from the least-squares means of the respective seasons of calving.

The mean persistency of yield over all lactations is 2.38. The highest persistency of yield was obtained for lactations commencing during the hot dry season (March - May) while the least was for those initiated during the post - rains period (September - November). The result showed significant effect of season of calving ($P<0.05$) and year of calving ($P<0.05$), on

persistency. Cows that calved during the March - May season differed significantly in persistency from those that calved during other seasons. Generally the results indicated that persistency was higher in dry season calvers than in wet season calvers. This agrees with the findings of Madalena et al. (1979) in Holstein - Friesians, Abubakar and Buvanendran (1981) in Friesian /White Fulani Bunaji Zebu cattle in the tropics and Bidanel et al. (1989) in Friesians under temperate environment. However, Sexena and Kumar (1960) did not observe any relationship between persistency and season of calving in Sahiwal Cows. Seasonal variations of persistency in dairy cattle were attributed to prevailing conditions of feed supply in the different months of the year (Mahadevan, 1951 and Ibeawuchi, 1984). There was no regular trend between persistency and the number of lactations and no significant effect of parity was recorded which is in agreement with the findings of Adeneye and Adebanjo (1978) for Friesians. However, this contradicts Zamorano (1986) who observed significantly higher persistency for Cows in their first lactation compared to those in other lactations It is, however worth noting that the number of cows in each parity was small and this may have affected the result.

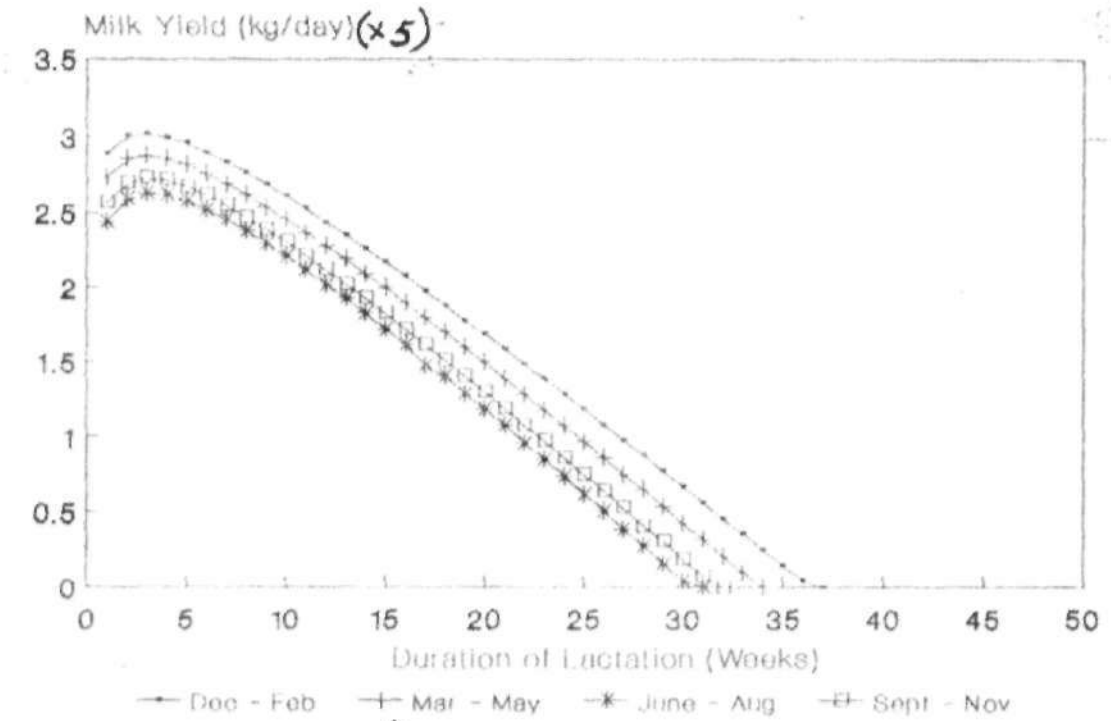


Figure 5.2 Lactation curves constructed from Least-Squares Means for Seasons of Calving

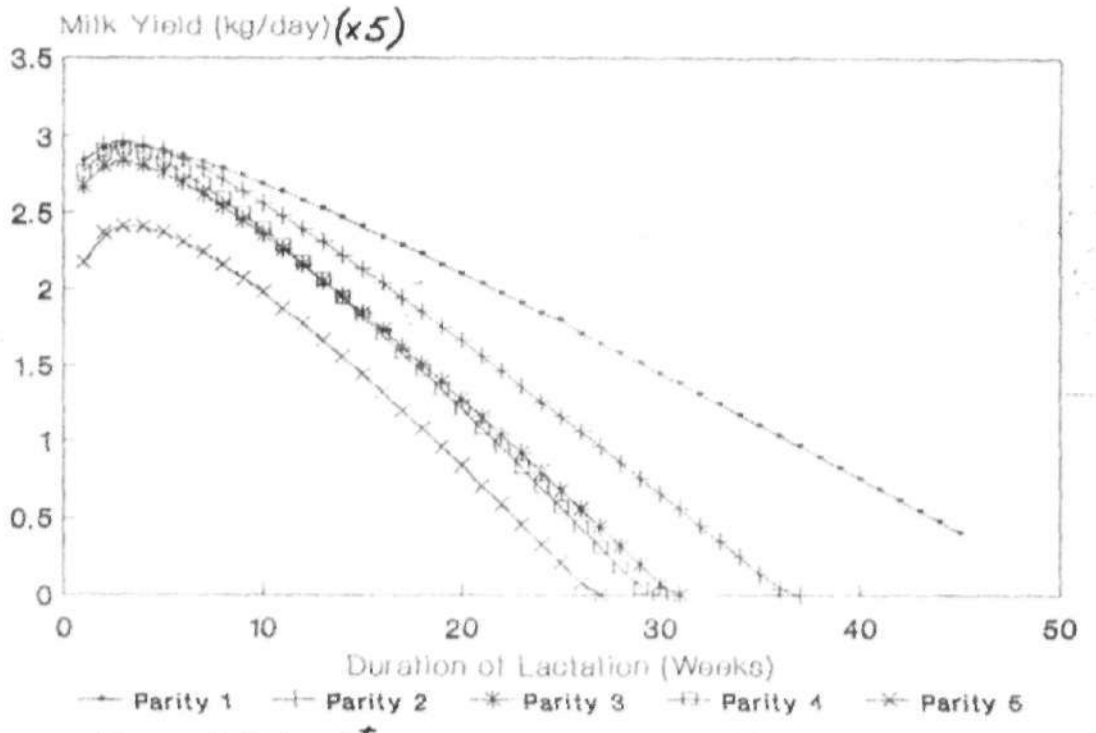


Figure 5.1 Lactation curves constructed from Least-Squares Means for Parity

CHAPTER SIX

6. GENERAL CONCLUSIONS

The present results suggest that the dairy performance of pure Friesian cattle at Kadawa is better than most earlier estimates in Nigerian. The performance is significantly influenced by environmental factors. This effect of the environmental factors on the performance of purebred Friesians at Kadawa is influenced to a greater extent by the poor climatic conditions, feeding and management, and the average genetic composition of the population. Imported heifers, generally seem to be superior to imported foetuses and locally born heifers in terms of milk yield, lactation length and other economic traits.

Since the results seem to indicate that cooler months are more favourable to milk production than warmer months it is suggested that dairy cows should be programmed to be calve during the cooler months, in the tropics. The results also indicated that persistency of yield was higher for dry season calvers than for wet season calvers. The result seems to

indicate that there is a considerable variations in the lactation curve parameters for Friesians in the tropics, due to the effects of season and parity of calving.

CHAPTER SEVEN

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