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A Comparative Study on Reproductive Performance of Cross-Bred Dairy Cows at Greater Rajshahi District

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Abstract: The main finding of the present study was to evaluate the reproductive performances of different crossbred dairy cows under field condition. In total of 313 dairy cows information were collected from 33 Artificial Insemination Sub-centres or Points under the District AI centre, Rajshahi at greater Rajshahi district over a period from 1993 to 2002. The reproductive parameters were such as age at puberty, age at first service, age at first calving, gestation length, post-partum heat period, days open, wastage day, service per conception and caving intervals. The information of the reproductive parameters were analysed from questionnaires answered by 33 FA (AI) and dairy cows owner's in respective AI Sub-centre or Points as well as from reading the AI and 100% progeny collection registers. In general, the mean age at puberty, age at first service, age at first calving, gestation length, post-partum heat period, days open, wastage day, service per conception and caving intervals were 27.9 month, 29.2 month, 38.7 months, 278.7 days, 20.7 kg, 139 days, 160 days, 20.3 days, 1.62 and 438 days, respectively. Genetic groups of L×F, L×F×SL, L×SL, L×S×SL and L×F×S×SL cows had significant effect on all the reproductive performances of dairy cows except on post-partum heat period, service per conception and wastage days. Among the 5 genetic groups, L×F cross-bred had shown excellent reproductive performances and most of these parameters were poor observed in L×S×SL cross-bred under field condition. It suggested that L×F cross-bred of dairy cows should be reared for better performance under rural condition.

Key words: Genotype, cross-bred, dairy cow, reproductive and performance

INTRODUCTION

Cattle being an integral component of the agricultural farming system of Bangladesh are utilized to produce milk and meat for human nutrition, draft power for cultivation, crop processing and rural transport, manure for producing fuel energy and enriching soil fertility. Now a day's cross-bred cow is popular in Bangladesh. The main aim of the production of dairy cows in Bangladesh is to produce milk, reproductive efficiency which is a major factor in the profitability of a dairy enterprise considering its effect on the annual milk production of the herd and the cost of herd depreciation. Proper insemination in right time, postpartum involution of uterus, pregnancy maintenance, easy parturition, nursing of the calves, balance feeding, adoption of appropriate feeding system and planned breeding must be improved to achieve the desired goal. Age of puberty, age of first service, age of first calving, parturition to first oestrus, parturition to conception, first service to conception interval, number of services per conception and reproductive disorders considered as some of the economically important traits in the dairy cattle. These traits are integral parts of the profit- loss equation in livestock production. The reproductive performance of the cross- bred cows differs from their local types due to different geographical areas[1,2]. The better reproductive and productive performances have been shown of Friesian cross-bred cows than other breed of cows[3-5]. Earlier, studies in large dairy herds and small hold farm levels identified delayed puberty, long post partum acyclicity and gynaecological problems as the major limiting factors against maintaining optimum reproductive efficiency of indigenous zebu cattle in Bangladesh[6-8]. Different types of cattle of tropical and temperate origin and their crosses are reared in different farms of Bangladesh for a long time. But no consensus has yet been established what types(s) of cattle are to be reared in the situation concerned. This study was therefore, under taken to evaluate the reproductive performance of dairy cows under District Artificial Insemination Centre(DAIC), Rajshahi at field condition in greater Rajshahi district with the following objective; i) To evaluate the effect of genotypes of dairy cows on reproductive parameters.

MATERIALS AND METHODS

The data used in the present study were collected from the record sheet maintained by Field Assistants (Artificial Inseminator) at 33 AI Sub-centres/AI Points of greater Rajshahi district as well as owners of dairy cows during 1993 to 2002. The reproductive performance

records of 313 dairy cows were analyzed. Thirty three Field Assistants (AI) of respective AI Sub-centre/ AI point were brought at District AI centre, Rajshahi for the training on reproductive performances of cows organized by Assistant Director (AD; AP), District AI centre, Rajshahi (Table 1). A questionnaire was made on reproductive parameters and detail instruction was given to the trainer. The main instructions were reproductive performances and how to fill up the questionnaire. The contents of this questionnaire also contains, date of AI, bull ID, type of semen used, breed of bull, dam history like birth date and management of cows, age of puberty, age at first calving, gestation length, S/C, post-partum period, open days and calving interval of progeny. The questionnaire had two parts, one was for FA (AI) and other was for owners of dairy cows. A total 500 questionnaires were distributed among the 33 Field Assistant (AI) and 6-15 questionnaire mention sire Id and breed for each Field Assistant (AI) to recorded the cows information from the field (Table 1). Field Assistants (AI) was collected necessary information from AI and progeny register as obtained from respective AI sub-centres/points and rest of the information were collected from farmers direct interviewing as per questionnaires. A total of 313 questionnaire/cow's information was collected from properly filled up forms or information collected by 33 Field Assistants (AI) of AI Sub-centres/Points of greater Rajshahi district. After collecting the questionnaire, preliminary sorting and checking, data were prepared for analysis. The cows were divided into 5 genotype groups according to their genetic composition;

Group I: Local × Friesian (L×F) cross, Group II: Local × Sahiwal × Friesian (L×SL×F) cross,
Group III:Local × Sahiwal (L×SL) cross,
Group IV: Local ×Sindhi × Sahiwal (L×S×SL) cross and
Group V:Local × Friesian × Sindhi × Sahiwal (L×F×S×SL) cross.

Feeding and management: An intensive and semi-intensive housing system was maintained for rearing of cows. On an average, ration per cow contained approximately 2-3 kg concentrates, 5-6 kg rice straw and 5-10 kg green grass with *ad libitum* water. The amount of concentrates was raised to 5 kg for high milking of progeny. The total amount of concentrate required per day were divided into parts and fed the cow twice daily. Rest of the period, the animal was maintained with rice straw and green grasses.

Insemination and medication: Artificial insemination was done by 33 trained Field Assistants(AI) with chilled or frozen semen of Friesian, Sahiwal bull or their crosses bulls. One FA(AI) was in-charge of each AI Sub-centre/Points for artificial insemination (AI) purpose. The farmers were regularly de-worming the cows by specific anthelmintics. All the animals were received vaccination against infectious diseases likes Anthrax, Hemorrhagic Septicemia, Black Quarter and Foot and Mouth disease.

Reproductive parameters studied: The following reproductive traits of cows were considered in this study.

Age at puberty: The age at which a heifer first shows estrous sign and behavior may be defined as age at puberty[9]. It was measured in month (m) and total number of observation was 313.

Age at fertile service: It is defined as the age when a heifer first conceives followed by heat. In this study total records for age at fertile service were 313 and it was measured in months (m).

Gestation length: It was calculated as interval from conceived to parturition. The duration of gestation was expressed in terms of days and total number of observation was 790.

Post-Partum Heat Period (PPHP): It is considered as the interval between date of calving and the date of first insemination. It was calculated in days and total number of observations for these traits was also 790.

Days Open (DO): In this study day's open was measured in days. Day's open is referred as interval from parturition to conception of cows.

Wastage Days (WD): It is considered as the mean first service to conception interval and it was measured in terms of days and

Calving Interval (CI): The number of days between two successive calving of the same cows or the period from one calving to the next was termed as calving interval. In this study calving interval was measured in days.

Design of experiment: Reproductive productive traits were utilized in this study. The collected data covered for five different groups. The number of animals in different AI Sub centres/Point and groups were unequal. In other word, the number of observations was different from class to class. So, the statistical design of the study was non-orthogonal factorial in nature.

Statistical procedure: Data were statistically analyzed to calculate the effect of genotype of dairy cows and various standard statistical procedures had been adopted in this

Table 1: Number of cross-bred cows were performed in different AI Sub-centres/ points at greater Rajshahi under DAIC, Rajshahi

Sr. No.	AI Sub-centre/AI point	No. of cows	Sr. No.	AI Sub-centres/AI points	No. of cows
1	Atria, Naogoan	12	18	Upazila Sadar, Naogoan	10
2	Bagatipara, Natore	8	19	Nakhopara, Bagmara	12
3	Laxmikul, Bariagram	10	20	Nawabgong Sadar	10
4	Bagha, Rajshahi	10	21	Paba, Rajshahi	5
5	Bodalgachi, Naogoan	12	22	Puthia, Rajshahi	14
6	Bonpara, Natore	9	23	Raninagar, Nawgoan	8
7	Charghat, Rajshahi	9	24	Rohonpur, Nawabgonj	8
8	Deluabari, Naogoan	7	25	Satbaria, Puthia	11
9	Dhanidho, Bariagram	11	26	Sibgonj, Nawabgonj	16
10	Gorudashpur, Natore	16	27	Singra, Natore	6
11	Lalpur, Natore	12	28	Tanor, Rajshahi	6
12	Madhnagar,Natore Sadar	16	29	Tokia, Natore Sadar	10
13	Mandha, Naogoan	6	30	Trimohoni, Nawabgonj	9
14	Mohadebpur, Nawgoan	6	31	Valukgachi, Puthia	9
15	Mohonpur, Rajshahi	6	32	Volarghat, Nawabgonj	6
16	Nachawal, Nawabgonj	8	33	Walia, Lalpur	6
17	Veterinary Hospita, Nawgoan	5	Total		313

study. The mean and standard deviation for the traits namely, age at puberty, age at first fertile service, gestation length, post-partum heat period, days open, wastage days, S/C and calving intervals were calculated with help of a computer package programme (SPSS). Mean of different genotypes were then tested by Duncan Multiple Range Test (DMRT) to determine the genotype effect according to Steel and Torrie[9,10]. The statistical model used to estimate the components of variance was as follows

$Y_{ik}=\mu + B_i + e_{ik}$

μ= overall mean

B_I= Effect ith genotype groups of cows where i = 1.....5

Y_{ik} is the individual record of kth individual cows.

RESULTS AND DISCUSSION

In total, 313 cross-bred cows were studied for the effect of genotypes of cows which produced from different AI Sub-centres/Points on reproductive traits were investigated in these animals and results and ANOVA are presented in Tables 2-3 and Fig. 1-3.The means along with SD for various reproductive traits in genetic groups of cows are presented in the Table 2. These Tables also show the significance of genetic groups, which is marked by superscripts.

Age at puberty: The lowest value of average age at puberty (26.7±4.0 m) was obtained in L×F×S×SL cross bred and the highest value (31.5±5.1 m) was in L×S×SL cross-bred cattle. The present study indicated that genotype of cows had significant effect on this trait. These results are partial supported by those of Haque[11] who note that the age at puberty of SL×Pabna (35.10 m), F×Pabna (25.53 m) and Pabna × Pabna (39.23 m) did differ significantly. Khan and Khatun[12] found no significant difference ($p<0.05$) among SL×Pabna (37.29 m), F×Pabna

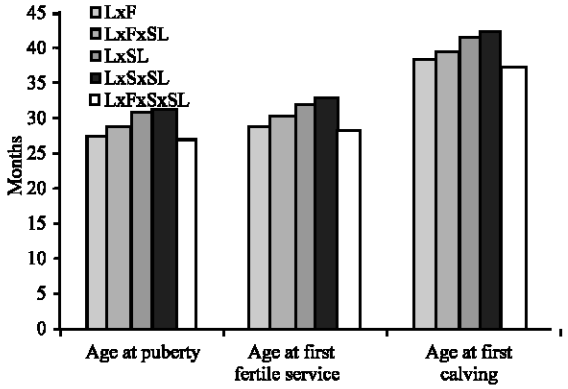

Fig. 1: Effect of genotypes of progeny on age at purbrty, age at first fertile service and age at first calving under field condition

(33.57 m) and Pabna ×Pabna (38.8 m) and this is higher than the present study. This result also supports these of Islam and Bhuiyan[13] who found significant ($p<0.05$) affect on 1/2SL×1/2Pabna (38.53 m) and 3/4SL×1/4 th Pabna (31.12 m). Majid[5] reported the age at puberty of SL×F cattle ranging from 606.4 days (20.2 m) to 770.31 days (25.68 month). Environmental condition, nutrition, care and management may also affect this trait. Finally, genetic make up is the main factor, which influences this trait remarkable.

Age at first fertile service: The lower age at first fertile service (28.1±4.2m) was observed in L×F×S×SL cross-bred and higher in L×S×SL cross-breed (32.7±5.2 m). Analysis of variance showed that age at first fertile service was significantly affected by genotype of cows (Table 3). In the present study, the overall age at first service was 29.2±6.4 months. Majid[5] observed that the age at first service of Local, 50%L×50%F and 50%SL×50%F was 32.2±50.9, 26.3±22.5 and 25.6±39.9 months, respectively which are close to this present study. Sarder[14] reported

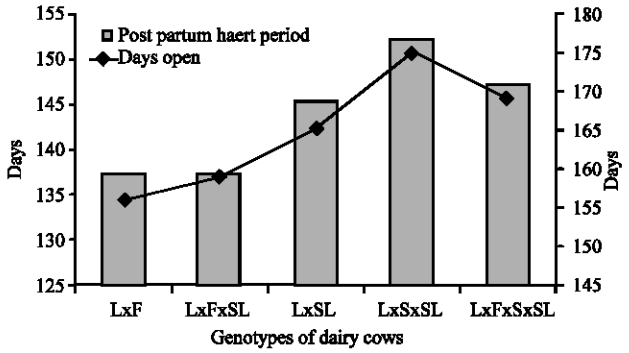

Fig. 2: Effect of genotypes of dairy cow on post-partum heat period and days open under field condition

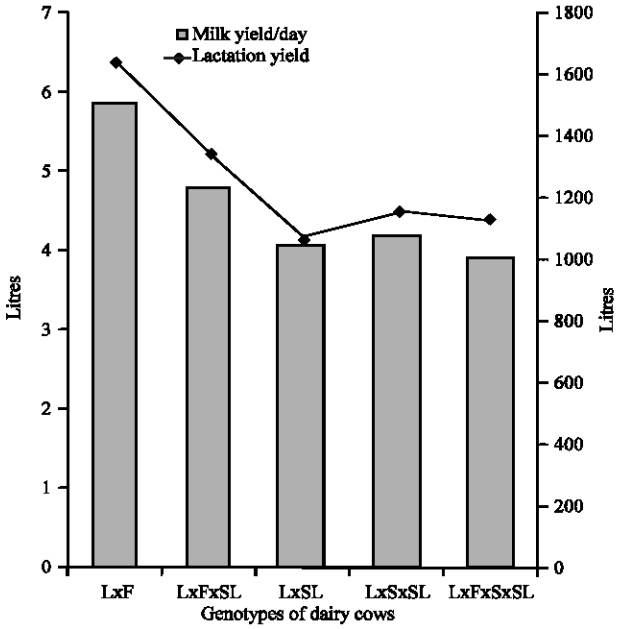

Fig. 3: Effect of genotype of progeny on milk yield per day and lactation yield under field condition.

that age at first service was found to be 30.3±7.0 months for the indigenous cows which is close agreement in the present study. Friesian cross cows showed early age at first fertile service than other genetic groups whereas Rahman[15] reported that average age at first service 47.3±0.5 months. Factors which results in delayed initiation of puberty include inadequate management and health care[16,7], state of nutrition[17]. The earlier in heifer if grater Rajshahi district dairy farmer could have been over come by the above-mentioned factor either individually or in combination.

Age at first calving: Average age at first calving in L×F×S×SL was found to be the lowest (37.2±4.2m) while in L×S×SL was the highest (42.2±5.3 m). Analysis of variance showed that age at first calving was significantly affected by genotype of cows (Table 3). Wilson[18] reported that tropical indigenous cattle normally calved for the first time between the ages of 36-42 months. Sarder[14] also reported that average age at first calving was found 39.7±7.0 months in indigenous cows. The finding of this present study fall within this range. Majid[5] also obtained age at first calving was 42.3 months. There are reports showing that under improve management and heath care and in optimum nutritional status, seasonal stress can be minimized to obtain first calving at about 3.5 years[16].

Gestation length: The gestation length was shorter in L×F cross-bred (278.0±4.9d) followed by L×F×S×SL (278.3±4.4 d), L×SL cross-bred (278.7±4.0d), L×S×SL (279.8±4.6 d) and L×F×SL (279.8±5.3 d) days. The genotypes of cows had significant influence on the gestation length (Table 2). Khan and Khatun[12,19,15] reported that gestation length was not significant in between genetic. Islam and Bhuiyan[13] who found the gestation length was corresponding figures for 1/2SL×1/2Pabna and $^{3}/_{4}$SL× ¼ th Pabna genetic groups to be 282.35 and 282.94 day, respectively. Khan and Khatun[12] reported the gestation length of SL×Pabna group to be 285.61 days which differs a little with the present findings. In case of F×Pabna and Pabna×Pabna genetic groups the present study was partially supported by Khan and Khatun[12] who reported that the gestation length of the two genetic groups was 282.75 days and 286.20 days, respectively. The effect of sire and dam on gestation length was significant, because it the species characteristic which is fixed genetically and variation may occur due to maternal and fetal and as well as seasonal influenced.

Post-partum heat period: Variation in PPHP in all genetic groups of progeny was found to be small and which was not obtained significant. The lowest average PPHP (137±48) was in obtained in L×F cross-bred and the highest (152±6.0 d) was in L×S×SL cross-bred cows (Table 2). The analysis of variance showed that the genotypes of cows were not significant ($p>0.05$) on this trait. Islam and Bhuiyan[13] also found no significant ($p>0.05$) difference between 1/2SLx1/2 Pabna 4.33 month or 121 days and 3/4SLx1/4 Pabna (4.38 month or 131.4 days) genetic groups, where as Majid[5] found a little variations in PPHP between different genetic groups which was not statistically significant. The reported that PPHP for ½ Local×1/2 Friesian cows was117.24±7.20 days. All these result are in agreement with the present study. The present findings is differ with other reporters may be due to genetic, environmental and mage mental factors.

Table 2: Effects of genotypes of cows on reproductive performances under field condition at greater Rajshahi district

	Genotypes of Dairy cows					
Reproductive parameters	L×F cross	L×F×SL cross	L×SL cross	L×S×SL cross	L×F×S×SL cross	Overall
Age at puberty (m)	27.0±7.0[b]	28.6±5.6[ab]	30.5±5.0[a]	31.5±5.1[a]	26.7±4.0[b]	27.9±6.3
	n=164	n=84	n=20	n=20	n=25	n=313
Age at first service(m)	28.4±7.0[b]	29.8±5.9[ab]	31.8±5.4[b]	32.7±5.2[a]	28.1±4.2[b]	29.2±6.4
	n=154	n=84	n=20	n=20	n=25	n=313
Age at first calving (m)	38.0±8.2[bc]	39.1±5.9[abc]	41.1±5.5[ab]	42.2±5.3[a]	37.2±4.2[b]	38.7±7.1
	n=164	n=84	n=20	n=20	n=25	n=313
Gestation length (d)	278.0±4.9[b]	279.8±5.3[a]	278.7±4.0[ab]	279.8±4.6[a]	278.3±4.8[ab]	278.7±5.0
	n=410	n=212	n=48	n=53	n=67	n=790
Post-partum heat period (d)	137±48	137±44	145±51	152±60	147±36	139±47
	n=407	`n=212	n=50	n=53	n=68	n=790
Days open (d)	156±51[b]	159±47[b]	165±27[ab]	175±64[a]	169±37[ab]	160±49
	n=407	n=211	n=50	n=53	n=68	n=789
Wastage days(d)	18.9±17	21.8±19	19.7±18	23.1±21	22.1±16	20.3±21
	n=407	n=211	n=50	n=53	n=68	n=789
Service/conception (S/C)	1.59±0.60	1.63±0.61	1.68±0.55	1.64±0.56	1.74±0.66	1.62±0.63
	n=406	n=211	n=50	n=53	n=68	n=788
Calving intervals (d)	434±51[b]	437±48[ab]	443±28[ab]	454±64[a]	447±39[ab]	438±49
	n=407	n=210	n=48	n=53	n=67	n=785

Values are mean±SD; n= Number of observation, a, b, and c values are differ from each others ($p<0.05$) . SL= Sahiwal, S= Sindhi, F= Friesian L= Local

Table 3: Analysis of variance for the reproductive performances of cows in five (5) genotypes under field condition at greater Rajshahi district

Reproductive performances	Sources of variation	D.F	Sum of square	Mean of square	F-value
Age at puberty (m)	Between Genotype groups	4	589.573	147.393	3.758
	Within Genotype groups	308	12080.381	39.222	
Age at first service (m)	Between Genotype groups	4	548.744	137.186	3.371
	Within Genotype groups	308	12534.605	40.697	
Age at first calving (m)	Between Genotype groups	4	514.548	128.637	2.545
	Within Genotype groups	308	15565.972	50.539	
Gestation length (d)	Between Genotype groups	4	539.250	134.812	5.463
	Within Genotype groups	785	19371.049	24.676	
Days open (d)	Between Genotype groups	4	25207.305	6301.826	2.618
	Within Genotype groups	784	1887404.941	2407.404	
Wastage days(d)	Between Genotype groups	4	1930.885	482.721	1.060
	Within Genotype groups	784	356926.037	455.263	
Service/conception	Between Genotype groups	4	1.462	.365	.924
	Within Genotype groups	783	309.598	.395	
Calving interval (d)	Between Genotype groups	4	26961.901	6740.475	2.722
	Within Genotype groups	780	1931723.034	2476.568	

Days Open (D): In the present study, the lowest number of days open was found in the L×F cross-breed (156±51 d) and highest period of days open was observed in L×S×Sl cross-breed cows (23.1±21 days) in L×S×SL cross-bred cows (Table 2). Analysis of variance was done and it shows a significant difference between genotypes of cows (Table 3). The significantly lowest days open in L×F cross-breed (156±51 days) and the highest in L x S x SL cross-bred (175±64 days) of the genetic groups of cows. The days open was relatively higher in the present investigation, which may be due to breed, sire, dam, nutrition, semen type, lactation length and frequency, poor heat detection and extension of post partum waiting period.

Wastage Days (WD): The lowest wastage days (18.9±1.7 days) was found in L×F cross-bred and highest (23.1±21 days) in L×S×SL cross-bred cows (Table 2). Analysis of variance shows that wastage day had not significant between genotypes of cows (Table 3). In the present investigation, the lowest wastage days were required for successful conception in genotype of L×F (18.9 days) than other groups. Shamsuddin[20] state that wastage days in 3 grade of concentrates viz. grade, grade and grade for 10±2.3, 19±2.7 and 28±4.3 days, respectively. Wastage days may depend on following factors-semen quality, inseminator stillness, free from reproductive diseases of cows, proper heat detection and management.

Service per conception (S/C): The average lowest number of service require for conception (1.59±0.6) was in L×F cross-bred and highest (1.74±0.66) in L×F×S×SL (Table 2). Chawdhury[21] also found services per conception of {F1, F2, F3 and F4} belonging to Holstein-Friesian, Sahiwal heifer and Sahiwal as 1.6±0.6, 2.2±1.3, 2.2±1.0, 2.5±1.2 and 1.5±1.0. This trait was not significantly affected by genetic

factors. Bhuiyan and Sultana[22] found that service per conception was 1.68±0.15 for F-L cross-bred which coincides with present study findings. The number of services per conception may be influenced by physiological condition of the sire, numbered percentage of viable sperm, semen preservation method insemination technique, timing of AI, stillness of the Inseminators and also reproductive soundness of the cows.

Calving intervals: The longer calving interval was found in L×S×SL cross-bred progeny (454±64 days) was shorter in L×F cross-breed progeny (434±51 days). ANOVA showed significant difference calving interval among the genetic groups of cows 5% level of significant (Table 2 and 3). Calving interval for L×F, L×SL×F, L×SL, L×S×SL and L×F×S×SLwas 434±51, 437±48, 443±28, 454±64 and 447±39 days respectively. Majid[5] also reported that average calving interval range from 434±51 to 454±64 days. Sarder[23] reported that calving to conception interval in Holstein-Friesian cross for 148±82, Sahiwal cross for 139±83, Sindhi cross 141±123, Jersey cross for 101±74 and Local for 116±41 days respectively. Calving interval is the best economic index of any dairy enterprises, which is ideally expected to be not more than 13 months. Being one of the major component of calving interval, parturition to conception interval, significantly influence the productivity of the progenies. In this study the average calving interval was found higher than expected standard. Most of the factors responsible for reducing calving interval are lack of nutrition, season of the service, poor heat detection, environmental determinant, little rainfall, high ambient temperature, suckling and post calving infection on female reproductive traits.

From the present study the L×F cross-bred of dairy cows had excellent performances for the reproductive parameters viz. age at puberty, age at first fertile service, age at first calving, gestation length, post-partum heat period, days open, wastage day, service per conception and caving intervals under field condition at greater Rajshahi district.

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