MATERIALS AND METHODS
Materials and methods

The present study was designed to study Hariana breed of cattle in its breeding tract to cover different aspects of cattle husbandry practices. Multistage stratified sampling procedure was used to select the districts, villages and respondents.

3.1 Selection of Study area

3.1.1 Selection of Districts

Rohtak, Hisar and Jhajjar districts of Haryana, which lie in the breeding tract of Hariana cattle, were selected for the study.

3.1.2 Selection of Villages

Six villages from Rohtak and five villages each from Jhajjar and Hisar district were selected randomly for the study of breed profile and their management practices, thus a total of sixteen villages (Kidhwali, Sanghi, Brahmanvas, Sisroli, Titoli and chidi from Rohtak, Lakadiya, Beri, Jondhi, Jhadli and Jahajgarh from Jhajjar and kimari, Harikot, Mangali, Harita and Singhran from Hisar district) had been incorporated for the first step objective assessment. The existing numbers of Hariana cattle and other relevant information from all the selected villages have been collected through schedule (Annexure I) incorporated for the intensive study of existing animal husbandry practices, production performance and economics of milk production of Hariana cows. The reasons for the selection of these districts were as follows.

1. These areas are the breeding tract of rural lifeline of cattle wealth of Hariana breed.

2. The rural economy of this region is dependent on Animal husbandry.

3. Scanty information on the Animal husbandry practices in Hariana breed is available.
3.1.3 Selection of Respondents

Step 1: After completing the survey of village for the cattle population, 160 respondents were selected through probability proportion of numbers of households with Hariana cattle from all sixteen villages for the documentation of existing managerial practices. The criteria used for the selection of respondents were herd size.

Step 2: Farmers from four villages which have true Hariana like cattle were selected as respondents for the study of production performance.

Step 3: Forty lactating cows (20 cows/ village) were selected from one village each of Rohtak and Jhajjar, one cow per respondents for the study of nutrient availability to lactating Hariana cows and economics of milk production of Hariana cows.

3.2 Parameters Studied

3.2.1 Documentation of existing managerial practices

A structured schedule (Annexure II & III) was developed for the collection of information on cattle management practices viz., breeding, feeding, housing, milking and healthcare practices, which were adopted by the respondents and also delineate the major constraints of cattle production system. The schedule was pre-tested for this purpose under existing field conditions before finalizing. Each selected respondent was interviewed personally for the collection of desired information.

3.2.2 Nutrient availability

Three main seasons of a year viz., summer, rainy or monsoon and winter were incorporated for the present study to find out the seasonal variations in nutrient availability.
Forty lactating cows (20 cows/village) were selected for the study of seasonal variation in the availability of nutrients during summer and winter seasons during the year 2007-08. Milk yield of individual selected Hariana cows was monitored in the form of kg day⁻¹.

### 3.2.3 Body Condition Score and Production Performance

#### 3.2.3.1 Body condition score

Body condition of the animal can provide valuable guidelines with regards to the energy status of the cow. Body condition scoring system is based on visual observations and/or palpation of vertebral column, transverse processes, tail head region and ribs of the animal and assigning numerical values to each point based on the amount of fat deposition over these points and differ only on account of the weightage given to the respective point and the scale used. To assess the body condition of animals following points were taken into account:

(i) Flesh covering at spinous processes of vertebral column (Chin, Loin and Rump region)

(ii) Prominence of spinous processes

(iii) Sharpness of spinous processes
(iv) Tail head region: prominence of depression between backbone and pins and in between pins and hook bones.

Considering these points, Prasad (1994) formulated a six point score chart which was used for measuring body condition score of cows and heifers in field conditions during different seasons and the animals were subsequently classified them under following 3 body condition classes (Prasad and Tomer, 1998).

<table>
<thead>
<tr>
<th>Body condition class</th>
<th>Body condition score (BCS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;3.0</td>
</tr>
<tr>
<td>Medium</td>
<td>≥3.0 - &lt;4.5</td>
</tr>
<tr>
<td>High</td>
<td>≥4.5</td>
</tr>
</tbody>
</table>

3.2.3.2 Production performance under field condition

The production and reproduction performance traits of Hariana cows under existing field conditions of its breeding tract were recorded in two ways.

a) Individual performance recording sheet.

The representative cows in early stage of lactation with Hariana like characteristics were selected (N = 40) for recording of various parameters of production traits with the help of individual performance recording sheet (Annexure IV). The following parameters were recorded:

- Identification mark
- Approximate age
- Date of calving
Lactation order

- Date of first service after calving
- Date of conception
- Date of drying
- Milk recording schedule

In milk recording schedule, monthly test day milk recording was taken for selected Hariana cows. The mean of the recordings was taken for estimation of lactation yield of 305 days through test day interval method, which approved by the International Committee on Animal Recording (ICAR). Simultaneously other parameters viz., number of services per conception, service period, dry period, lactation length and calving interval were generated through above recorded information.

b) Production performance based on the information provided by respondents

Production performance traits (Annexure III) of Hariana cows were recorded during the interview of selected respondents for the management practices.

3.2.3.3 Economics of milk production

Expenditure incurred on different items of cost of milk production and methodology used for calculating the cost of milk production was is illustrated below.

a) Cost of milk production

The cost involved in milk production had been categorized into fixed cost and variable cost.

i) Fixed cost (FC)

It refers to those costs which remain unchanged over a short period of time. The relevant components of fixed cost that were taken into milk production are;
Depreciation $(D)$:

It is the loss in value of an asset due to wear and tear. Depreciation in cattle shed, dairy equipments and animals was considered. An annual depreciation of 20 per cent was assumed on kutch movable shed structure as prevalent in the study area and 10 per cent depreciation was assumed for dairy equipments. The depreciation of milch cow was taken as per procedure given by Patel (1979). The annual depreciation expenses were apportioned per Standard Animal Unit (SAU) as given by Kumbhare et al. (1983).

Interest on fixed capital $(IFC)$:

The value of milch cow, cattle shed and other equipments related to milk production was taken as the fixed capital. The interest on fixed assets was calculated @ 8.5 per cent, which match the interest rate provided by the commercial bank on fixed deposits. The annual interest was worked out per SAU per day.

ii) Variable cost $(VC)$

The important items of expenses included in the variable costs were green fodder, dry fodder, concentrate, human labour, veterinary and miscellaneous expenses such as ropes, chains, electricity, water, minor repairs and other minor expenses. The variable cost of inputs namely feed and labour was computed by ascertaining the actual quantities utilized per lactating animal per day and multiplying the physical units by their respective market prices or actual cost incurred depending on whether the input cost was farm produced or purchased.

iii) Gross cost $(GC)$

The gross cost of milk production is computed as the sum total of fixed costs and variable costs. This gives a picture of total implicit and explicit costs that have been incurred
in the milk production.

*iv) Net cost (NC)*

The net cost of milk production of the sampled households was worked out by deducting the imputed value of dung from the gross cost. The dung of cow has wide range of utility in the area such as construction of kutcha human shelter, cooking of food and manuring of field. The assumed market value of dung was taken as Rs. 2.00 day$^{-1}$ SAU$^{-1}$ in summer and winter seasons while Rs 1.50 day$^{-1}$ SAU$^{-1}$ in rainy season due to losses of droppings during grazing.

**b) Returns from milk production**

The income from milk production was categorized on the following pattern.

*i) Gross Income (GI)*

It was worked out by adding the value of milk and dung produced by the milch cows of the sampled households.

*ii) Net Income (NI)*

This is the true reflection of the income, which was calculated by deducting gross cost from gross income.

**3.3 DATA COLLECTION**

The procedure for collection of data has been described under as per objectives assessment.

**3.3.1 Estimation of Population Figure of Hariana Cattle**

For the estimation of total Hariana cattle population in its breeding tract the primary and secondary data were collected.
3.3.2 Documentation of existing cattle management practices

The primary data of management practices were collected by using the structured schedule as given in annexure II and III.

3.3.3 Body Condition Score

The data of BCS of Hariana breed were classified according to animal type and season.

Animal type

The animals were categorized as:

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Code</th>
<th>Number of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heifers</td>
<td>1</td>
<td>468</td>
</tr>
<tr>
<td>Dry cow</td>
<td>2</td>
<td>433</td>
</tr>
<tr>
<td>Lactating cow</td>
<td>3</td>
<td>410</td>
</tr>
</tbody>
</table>

Season

Three seasons were classified as:

<table>
<thead>
<tr>
<th>Season</th>
<th>Code</th>
<th>Number of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>1</td>
<td>474</td>
</tr>
<tr>
<td>Monsoon</td>
<td>2</td>
<td>454</td>
</tr>
<tr>
<td>Winter</td>
<td>3</td>
<td>383</td>
</tr>
</tbody>
</table>
3.4 STATISTICAL ANALYSIS OF DATA

3.4.1 Documentation of existing cattle management practices

Cattle management practices were documented by tabular analysis (Snedecor and Cochran, 1989).

3.4.2 Body Condition Score

The data were analyzed through least square analysis of variance procedure (Harvey, 1976) by using the following mathematical model.

\[ Y_{ijk} = \mu + A_i + S_j + e_{ijk} \]

Where,

- \( Y_{ijk} \): \( k^{th} \) observation in \( i^{th} \) animal type and \( j^{th} \) season
- \( \mu \): Population mean
- \( A_i \): Effect of \( i^{th} \) animal type (\( i^{th} = 1, 2 & 3 \))
- \( S_j \): Effect of \( j^{th} \) season (\( j^{th} = 1, 2 & 3 \))
- \( e_{ijk} \): Random error. \( \text{NID}(0, \sigma^2_e) \)

The pairwise comparison of least squares means was done by using Duncan’s Multiple Range Test (Kramer, 1957).