2. MATERIALS AND METHODS

In this chapter the experimental techniques used to estimate the nutritive value of green fodder and silage of the best selected treatment combinations (Vidisha 60-1 variety of jowar at 60 kg nitrogen level and soil + spray application of urea) have been detailed.

2.1 Cultivation of fodder

On the basis of production and evaluation studies carried out in part I & II the best performance was found to be with Vidisha 60-1 variety of jowar fertilised at the rate of 60 kg N/ha through soil + spray application of urea. For conducting feeding cum metabolic trial, Vidisha 60-1 was grown on an area of one acre. A pre-sowing irrigation was given on 12th July, 1972. When the land came in condition on 16th July, 1972 two cross operations were given with tractor drawn disc harrow. A basal fertilisation of 60 kg P2O5 and 30 kg K2O along with 30 kg N per hectare in the form of urea was broadcast. At the rate of 50 kg per hectare, 20 kg of seed was broadcast on 19th July, 1972 and an operation was given with disc harrow to which a plank was attached. Altogether three irrigation were given, viz., on 5th August, 15th September and 29th September, 1972. There was a moderate attack of shoot fly and stem borer on the
crop during this season; which was not found during the first year. For the control of shoot-fly, endrine emulsion was sprayed at the rate of half litre per acre in the form of 0.05 per cent solution twice on 21st August and 18th September, 1972, respectively. For the control of stem bo-rer endrine granules at the rate of 3.5 kg per acre and 15 to 20 granules in the whorle of each plant were applied. The remaining 30 kg N per hectare was given through urea in the form of spray of 2 per cent solution in two doses on 45 and 60 days after sowing. When the crop reached to dough milk stage (Photograph 1) it was used for feeding cum metabolic trial and conservation in the form of silage.

2.2 Preparation of silage

Silage was prepared in experimental concrete jowar silos. The green fodder was harvested with sickle and chaffed on bringing at the silos with the help of mechanically operated chaff-cutter. The chaffed material was put into silos (Photograph 2) well packed and after a slight sinking, again the material was put, pressed and covered with air tight polythene sheet and wooden planks (Photograph 3). This remained in the silo for 130 days.

2.3 Selection of animals

Six healthy mature and dry Tharparkar cows (Bos indicus) were selected each time for conducting metabolic trial on green
1. Vidisha 60-1 variety of Sorghum at harvest (soft dough) stage.

2. Chaffing of Sorghum and filling of silos.
EXPERIMENTAL SILAGE
EFFECT OF DIFFERENT LEVELS
Of NTBOGEN & METHODS OF
APPLICATION OF UREA
ON THE NUTRITIVE VALUE OF
UOWAR SILAGE

3. The experimental silos.

4. Energy value estimation with the help of Ballestic Bomb Calorimeter (Gallen-Kamp) CB-370.)
and silage. Care was taken to minimize the experimental error by narrowing the range of weight of the animals as far as possible. Details of animals for both the trials were in Table 41.

**TABLE 41**

**Details of experimental animals**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Number of animals</th>
<th>Body weight in kg</th>
<th>Metabolic body size $\frac{W^{0.75}}{kg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>596</td>
<td>424</td>
<td>96.39</td>
</tr>
<tr>
<td>2</td>
<td>599</td>
<td>472</td>
<td>101.30</td>
</tr>
<tr>
<td>3</td>
<td>600</td>
<td>300</td>
<td>77.42</td>
</tr>
<tr>
<td>4</td>
<td>674</td>
<td>349</td>
<td>80.74</td>
</tr>
<tr>
<td>5</td>
<td>730</td>
<td>389</td>
<td>87.58</td>
</tr>
<tr>
<td>6</td>
<td>748</td>
<td>395</td>
<td>88.52</td>
</tr>
<tr>
<td>Average</td>
<td>396.17</td>
<td>± 21.99</td>
<td>± 3.70</td>
</tr>
<tr>
<td>SE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Silage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>590</td>
<td>396</td>
<td>88.77</td>
</tr>
<tr>
<td>2</td>
<td>651</td>
<td>337</td>
<td>78.65</td>
</tr>
<tr>
<td>3</td>
<td>652</td>
<td>405</td>
<td>90.29</td>
</tr>
<tr>
<td>4</td>
<td>658</td>
<td>360</td>
<td>82.64</td>
</tr>
<tr>
<td>5</td>
<td>682</td>
<td>422</td>
<td>93.10</td>
</tr>
<tr>
<td>6</td>
<td>814</td>
<td>337</td>
<td>78.65</td>
</tr>
<tr>
<td>Average</td>
<td>376.00</td>
<td>± 31.79</td>
<td>± 2.54</td>
</tr>
<tr>
<td>SE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.4 Housing of animals

The animals were housed in a well ventilated and well built metabolism stalls, so as to keep them comfortable. The feeding troughs and floor were made of cement concrete, with partition of iron bars. The feeding troughs were constructed in a special design, so that while being sufficiently deep to hold the roughages given at a time, was yet shallow enough for the animals to reach easily. The bottom of it was constructed, as to have no corners and also finished very smooth with a layer of cement, which enabled to removal of entire residue without any losses. All the animals were tied up in King and Louden system of stanchions, which while giving them the free movement, yet prevented them from getting access to the feed of other animals. This arrangement also prevented them from scattering the feed. Individual animal had sufficient space to stand and lie down. They were kept in healthy surrounding with a tail to tail system for proper cleanliness.

2.5 Preliminary feeding

Before the start of the actual metabolism trial, the animals were put to preliminary feeding of 15 days. The purpose was to eliminate the residual effect of the previous feed. Besides this, it also helped them to get accustomed to the feed and the stalls.
2.6 Period and duration of metabolism trials

The metabolism trial of green fodder commenced on 30th October and continued up to 5th November, 1972, and for silage commenced on 24th March and continued up to 30th March, 1973, thus keeping the conventional metabolism trial of seven days collection period for green as well as silage.

2.7 Feeding and sampling of ration

2.7.1 Green jowar: Each day adequate quantity of green (Sorghum vulgare) based on the preliminary feeding trial, was harvested from the field, chaffed with manually driven chaff-cutter and brought immediately to the feeding stall. Just after the arrival of the green chaffed fodder to the feeding stall, a representative sample was drawn after mixing the material thoroughly in duplicate and was brought to the laboratory in polythene bags for estimation of dry matter and crude protein, each day. Every day, forty kg of green chopped jowar was offered to each animal, based on preliminary feeding trial so that the supply of green fodder remains ad lib. Harvesting, chaffing and transportation of chaffed fodder to the feeding stall was arranged in such a way that the fodder was offered to animals each day at 11:00 a.m. and not giving extra time to the harvested or chaffed fodder for drying.
The residue of left over, was collected on the next day; weighed individually for each animal and a representative sample from left over of each animal was drawn for estimation of dry matter and crude protein. The weight of the left over of each animal was recorded in a suitable proforma and thus the total intake per animal per 24 hours was recorded.

2.7.2 Silage: Each day, adequate quantity of jowar silage, based on the preliminary feeding trial was taken from the concrete silos and brought to the feeding stall. A known quantity of the representative sample after thorough mixing was drawn for DM and crude protein estimation. The estimations were done in duplicate daily. Each day, at the prescribed time i.e. 10.30 a.m. twenty five kg silage was weighed and given to the animals, based on preliminary feeding trial so that the supply of silage remained ad lib. The residues of each day were collected on the next day, weighed and representative samples drawn for dry matter and crude protein analysis.

2.8 Watering

Clean and wholesome water was offered ad lib. twice daily, that is morning and evening (at 10.00 a.m. and 5.00 p.m., respectively) in a graduated bucket. The water drunk by each animal was also recorded.

2.9 Weighing of animals

The weight of animals were recorded in the morning before any feed or water was given. The animals were weighed.
before the metabolic trial commenced and at the end of the metabolism trial. The mean of these two weights was taken as the basis of all the calculations.

2.10 Watch

Throughout, the day and night watch was kept with the help of specially trained attendants to ensure proper collection of feeds, faeces and urine.

2.11 Collection of faeces

The faeces voided out by the animals during the 24 hours were collected in a labelled and weighed tin, uncontaminated by urine or feeds. At the end of 24 hours (at 10.00 a.m. daily) the faeces were weighed and recorded.

2.12 Collection of urine

All the cows were fitted with urine collection bowls. The urine was collected by means of rubber tubing attached at the opening of the bowl. The end of the rubber tubing was carried into a labelled and covered tin placed inside a cement concrete pit behind each animal. At the end of 24 hours (at 10.00 a.m.) the tins were emptied and the volume of urine was recorded with the help of a measuring cylinder.

2.13 Sampling of faeces

As already stated, at the end of 24 hours, the dung voided out was weighed accurately. Later it was mixed thoroughly
by rubbing on palm and then a homogeneous and representative sample was drawn in a covered plastic container separately for each animal. After bringing it to the laboratory, the upper layer of the dung sample was removed and from the remaining portion a 1/100th part of the total faeces voided out by each animal was weighed separately in previously weighed shallow aluminium trays. The samples were well spread in the trays and kept in hot air oven, maintained at 100 ± 2°C for dry matter determination. This process of collection, weighing and drying, continued until after the 7th day of the collection. Thus, all the dry faeces was collected in the respective labelled containers, and were stored in the powder form for further analysis.

For nitrogen estimation, 1/500th sample of the total faeces voided out was weighed in a watch glass and after mixing with 5 ml of 25 per cent H₂SO₄ (preservative) it was transferred to previously weighed and labelled glass bottles. The bottles were stoppered well. Such samples were pooled for seven days. At the end of the collection period, the preserved faeces in the bottle was mixed well and an aliquot (20 g) from this duplicate was used for nitrogen determination.

2.34 Sample of urine

The entire urine of the individual animal excreted during 24 hours was measured volumetrically daily. A homogenous
sample was collected in a polythene bottle properly cleaned and labelled for each animal. An aliquot of 1/500th part of urine was collected every day in plastic bottles containing 1 ml potassium dichromate mercuric chloride solution (87.5 and 12.5 g respectively per litre of distilled water) for the estimation of gross energy of urine.

2.15 Method for chemical analysis

2.15.1 Dry matter estimation: Dry matter of green jowar was estimated by drying the sample at 100 ± 2°C to constant weight in hot air oven. The faeces samples were dried at 100 ± 2°C to constant weight. The silage samples were dried in hot air oven at 95°C to constant weight.

Upon completion of drying under above conditions the seven days samples were pooled together; mixed well and ground in a micro wiley mill through a 40 mesh sieve to obtain the sample for the determination of gross energy, ether extract, acid detergent fibre and ash.

2.15.2 Nitrogen estimation: Fresh sample of green jowar and silage and wet sample of faeces were used for determination of nitrogen using routine macro kjeldahl method. The nitrogen values thus obtained were multiplied by 6.25 to find out the crude protein.
2.15.3 Acid detergent fibre: Acid detergent fibre was estimated by the method suggested by Van Soest (1963).

2.15.4 Ether extract: By Soxhlet extraction method of A.O.A.C. (1960).

2.15.5 Ash: Ash was analysed as per method of A.O.A.C. (1960).

2.15.6 N.F.E: Nitrogen free extract was calculated by difference 100—(CP% + EE% + CF% + total ash%) as described by A.O.A.C. (1960).

2.16 Calorific values of feed and metabolic samples

The calorific value of the feed, faeces and urine were estimated by Ballistic Bomb Calorimeter (Grallen Kemp, CB-370) (Photograph 4).

2.16.1 Feed: One g dried and finely ground sample was weighed in capsule and its calorific value was measured by burning in the bomb.

2.16.2 Faeces: One g of dried finely ground faeces samples was taken in the capsule. Its calorific value was measured by burning in the bomb.

2.16.3 Urine: In the present investigations 2 ml of urine sample was absorbed in 1 g pure cellulose, and freeze dried at minus 45°C. The calorific value of pure cellulose was
estimated by burning it alone in capsule. The CH$_4$ losses were estimated as per McDonald et al. (1973).

2.17 **NVI (Nutritive Value Index)**

Nutritive value index was calculated by the formula suggested by Crampton et al. (1960):

\[
\text{NVI} = \frac{10 \times (\text{g intake})}{80 \times (W^{0.75} \times \text{kg})} \times \text{Digestible dry matter (percent)}.
\]

2.18 **Statistical analysis**

't' test was used to compare the digestibility coefficients and intake of green and silage (Snedecor and Cochran, 1967).

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