For maximizing the animal production, nutritionally balanced and cost effective feeding are the most important prerequisites. So, minimizing the feed cost would be a great achievement for livestock and poultry farmers if the cheaper unconventional and potentially useful ingredients, like Seabuckthorn (SBT) cake are introduced as the protein and energy source, because nutritionally, SBT cake is very rich in proteins, fat, amino acids, vitamins and minerals. A very little systematic and scientific work has been carried out to study the effects of feeding SBT cake to the cattle, poultry and other animals to evaluate its nutrient utilization for various functions. So, an attempt was made through this study to evaluate the effect of replacement of crude protein of conventional feed of layers and calves with crude protein of SBT cake for the optimum production with following objectives:

iv) To evaluate biological performances of commercial layers and calves by feeding Seabuckthorn cake (*Hippophae L*).

v) To study the nutrient availability after replacement of crude protein of conventional concentrate with Seabuckthorn cakes at different levels in layers and calves.

vi) To study the feed conversion ratio for layer and calf production.

To test the replacement of conventional concentrate rations CP with SBT cake CP, three experiments were conducted. The first experiment was conducted in 360 (BV-300) layer chicks which were divided randomly into 6 treatment groups and offered conventional ration in control group (S₀) replacing 10, 20, 30, 40 and 50 per cent CP by SBT cake CP in S₁₀, S₂₀, S₃₀, S₄₀ and S₅₀ treatment groups respectively. The second experiment was conducted in crossbred calves where 18 calves of 4-5 months age were randomly divided in 3 treatment groups having 6 animals in each group. The calves were offered conventional calf grower ration (CGR) in control (SBT₀) group and replacing 50 (SBT₅₀) and 75 (SBT₇₅) per cent CP of SBT₀ ration with the CP of SBT cake. The third experiment was conducted to investigate the effect of SBT cake on rumen metabolites and
rumen microbial population in adult cattle. Three adult fistulated cattle (Body Weight ~250 kg) were maintained on the experimental rations where the crude protein of the basal ration \( T_1 \) was replaced with SBT cake CP at 50 \( T_2 \) and 75 \( T_3 \) per cent of CP in a switch over design.

**Experiment I**

In the first experiment, the effect of CP replacement of the conventional poultry ration with SBT cake on biological performance of layer chicks during starter, grower and layer phases was studied. Significantly higher (P<0.05) average gain in weight was found in \( S_0 \) and \( S_{10} \) and \( S_{20} \) treatment groups during starter phase and the best FCR was observed in \( S_{20} \) during starter and grower phases of the layer chicks. Moreover, the highest average gain in weight (999.83±10.81 g) and the best FCR (3.73±0.04) was found in \( S_{20} \) treatment groups during 1\(^{st}\) to 17\(^{th}\) weeks of age of the layer chicks.

The digestibility of DM and nutrients were found significant (P<0.05) for CP, EE, CF and OM digestibility. For CP and EE digestibility, the performance of \( S_{20} \) group was the highest followed by \( S_{10} \) and \( S_0 \) treatment groups. During laying phase, the biological performances in respect of DMI (g per dozen eggs), per cent of egg production, fortnightly egg production, egg mass production, feed efficiency, and weight per dozen egg of layer, \( S_{20} \) group showed significantly (P<0.05) better performance followed by \( S_{10} \) and \( S_0 \) treatment groups.

Magnesium, iron, sodium and potassium content of the blood serum were found non-significant among all the treatment groups. Calcium and zinc were significantly higher (P<0.05) in \( S_0 \) treatment group and were in decreasing trend with the increased level of SBT cake CP in layer ration. The opposite trend was found for cobalt content in blood serum whereas, highest copper was found in \( S_{20} \) group followed by \( S_{30}, S_{10}, S_0, S_{40} \) and \( S_{50} \) treatment groups. Copper level of blood serum increased sharply up to 20 per cent level of inclusion of SBT cake and thereafter it decreased sharply. The highest manganese content was found in \( S_{10} \) group followed by \( S_{20}, S_0, S_{30}, S_{40} \) and \( S_{50} \) treatment groups.

The largest profit was obtained in \( S_{20} \) group followed by \( S_0, S_{10}, S_{50}, S_{30} \) and \( S_{40} \) treatment groups respectively. It indicated that the birds belonging to \( S_{20} \) group where the 20 per cent CP of the feed was replaced by the CP of SBT cake was more profitable.
Experiment II

In the second experiment, the effect of CP replacement of conventional CGR with SBT cake on growth, nutrient availability and digestibility performances of calves were studied. DMI (kg/d) and OMI (kg/d) of calves were found significantly higher in SBT$_{50}$ treatment group followed by SBT$_{0}$ and SBT$_{75}$ treatment groups. The total CP (kg/d), DCP (g/d) and TDN (kg/d) intake of calves were found significantly higher in SBT$_{50}$ group followed by SBT$_{0}$ and SBT$_{75}$ treatment groups. The total weight gain (kg) and average daily gain (kg) of calves were significantly (P<0.05) higher in SBT$_{50}$ group followed by SBT$_{0}$ and SBT$_{75}$ treatment groups. The highest DMI (kg/kg gain) and minimum production cost (Rs./kg) were recorded in SBT$_{50}$ group followed by SBT$_{0}$ and SBT$_{75}$ treatment groups. Significantly higher (P<0.001) nitrogen balance (g/d) was observed in SBT$_{50}$ group followed by SBT$_{0}$ and SBT$_{75}$ treatment groups.

The digestibility of all the nutrients except CP, EE and cellulose, followed the decreasing trend with the increased level of SBT cake. Whereas, in case of CP, EE and cellulose digestibility per cent increased at 50 per cent level of replacement of inclusion of SBT cake and decreased with the increased level of SBT cake at 75 per cent level.

The blood serum mineral levels were having the same trend as observed in poultry layer experiment.

Experiment III

The highest and the lowest values of pH were found at 12 h and 24 h in all the treatments T$_1$, T$_2$ and T$_3$. The TVFA concentration of rumen liquor reached at peak levels at 24 h, 4 h, and 16 h post feeding in T$_1$, T$_2$ and T$_3$ treatment groups respectively. The NH$_3$-N concentration in rumen liquor reached the highest concentration at 4h post feeding in T$_1$ ration, 2 h post feeding in T$_2$ and T$_3$ treatment groups and the lowest level was observed at 20 h post feeding in all the treatment groups. The total-N concentration in rumen liquor reached the highest concentration at 12 h, 16 h, and 12 h post feeding in T$_1$, T$_2$ and T$_3$ treatment group respectively and the lowest level was observed at 24 h post feeding in all the treatment groups. The TCA-N concentration was the highest at 12 h, 16 h, and 12 h post feeding in T$_1$, T$_2$, and T$_3$ treatment group respectively and the lowest level was observed at 24 h post feeding in the entire treatment group. The highest NPN
concentration was recorded at 12 h post feeding in all the treatment groups and the lowest was at 24 h post feeding in all the treatment groups.

The bacterial population \((\text{cell}\times10^{10})\) reached peak level at 16 h, 20 h and 2 h post feeding in T\(_1\), T\(_2\) and T\(_3\) treatment group and the lowest values were found at 24 h, 20 h and 24 h post-feeding in T\(_1\), T\(_2\) and T\(_3\) treatment group respectively. The rumen protozoal population \((\text{cell}\times10^6)\) reached the peak at 12 h post feeding in T\(_1\) and T\(_2\) ration and 20 h of post feeding in T\(_3\) treatment group.

It was concluded that T\(_2\) ration gave better rumen metabolites for optimum growth and multiplication of rumen bacteria and protozoa.

**Conclusions:**

- The egg production, egg mass and body weight gain of layers were higher in S\(_{20}\) group where 20 per cent CP of conventional concentrate was replaced with the CP of the SBT cake.
- FCR in respect of growth performance as well as egg mass of the layers was found better in S\(_{20}\) treatment group.
- As the level of SBT cake increased beyond 20 per cent, the biological performance of the layers declined.
- The quality traits of eggs were not affected by replacement of SBT cake at any level.
- Replacement of CP of conventional layer feed with SBT cake CP upto 20 per cent level was economic for layer production.
- Higher body weight gain and better balance of nutrient in calves was observed in SBT\(_{50}\) group where 50 per cent CP of the traditional CGR was replaced with the SBT cake CP.
- Better FCR of calves was found in SBT\(_{50}\) group, hence, can be considered as the highest level of replacement with SBT cake CP in CGR.
- Higher microbial population in adult calves was found in T\(_2\) group, where 50 per cent CP of the traditional adult calves ration was replaced with the CP of SBT cake.
- Better rumen metabolites were found at 50 per cent replacement level.
Lastly, it may be summed up that 20 per cent CP of the traditional concentrate ration can be replaced with the CP of SBT cake in layer birds, whereas, 50 per cent CP of the traditional concentrate ration can be replaced with the CP of SBT cake in growing as well as adult cattle.