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Uses of unconventional feed in livestock production of Bangladesh

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Abstract
Bangladesh is now progressing on feeds of balanced ration. Preferred unconventional feed supplements are now trends for the nutritional balance in commercially manufactured contents. The fibrous carbohydrates represent the portion of the ration that is more slowly digested. The fibrous carbohydrates occupy more space in the gut and require extensive chewing to reduce the particle size for passage to the lower digestive tract. The fiber in a ration is analyzed by laboratory procedures for either crude fiber, acid detergent fiber (ADF), or neutral detergent fiber. The neutral detergent fiber (NDF) procedure measures all the cellulose, hemicellulose, and lignin. Crude fiber measures only cellulose and some lignin; acid detergent fiber measures cellulose and all the lignin. For this reason, acid detergent fiber (ADF) appears to be more closely associated with digestibility and neutral detergent fiber (NDF) to rumen fill or dry matter intake. Since dry matter intake and milk production correlate closely, with livestock populations, especially dairy and poultry, any component of the ration affecting dry matter intake would increase the feed conversion ratio affecting milk and meat production. The suggested fiber is supposed to utilize in the content of rations for high-producing cows and poultry.

Keywords: ADF, Crude protein, NDF, FCR

Introduction

Bangladesh is one of the most densely populated countries in the world with a population of 150 million and the current population growth rate is about 1.50% per annum. Agriculture as well as livestock plays a vital role in the development of the people as well as in the economic development of Bangladesh. In 2020/21, the contribution of the livestock sub-sector to the total GDP is 1.98% (GOB, 2021 DLS) [15]. Bangladesh has a relative density of livestock population compared to many other countries of the world. The cattle population in Bangladesh 2nd among the SAARC countries and 7th among the Asian countries. The last census about livestock population was estimated (GOB, 18th June 2021, DLS) [15] at 25.07 million cattle, 0.83 million buffaloes, 14.8 million goats, 1.9 million sheep, 118.7 million chickens, and 34.1 million ducks. Despite the high density of the livestock population, the country suffers from an acute shortage of livestock products like milk, meat, and eggs due to the large number of people. The shortage of livestock products is attributed mainly to the poor quality of livestock species and their low productivity. The low productivity of local breeds of animals is an important constraint to the future development of the livestock sector in Bangladesh. Nutritionally balanced and efficiently-utilized rations are to formulate diets with an optimum amount of both structural and nonstructural carbohydrates that maximize production performance. The diets containing 36% NSC resulted in the highest passage of bacterial nitrogen to the small intestine from continuous culture studies that diets with an NSC level of about 37% of DM provided sufficient energy for optimum microbial growth. The previous work (Stern, MD. and Zirmer, CJ. 1993) [38] conducted a study where cows were fed low (24.9%) or high (32.9%) starch-containing diets. Cows fed high-starch diets increased in milk production (P<.07) and DM (P<.08) compared to those fed the low-starch diet. The report on dairy rations (Nocek, 1993) concluded in descriptive literature that appropriate nitrogen or protein fractions must be provided with these various carbohydrate fractions for optimal microbial synthesis and carbohydrate utilization to occur. Nonstructural carbohydrates (NSC) represent the more rapidly digested fractions in the rumen. In plants, they are located mostly in the seeds. While different equations have been developed for calculating NSC, this paper is used where NDF (neutral detergent fiber). An experiment was conducted by previous years (Staples *et al*., 1992) to evaluate the value of NDF concentration in diets to formulate the desired forage-to-concentrate ratio. Forages selected for the study included corn silage, elephant grass silage, Bermuda silage, and sorghum silage. The forages were adjusted in the diets to give NDF values of 31, 35, and 39 percent. Milk production averaged nearly 50 lb/day over the 84-day experiment. All silages, except for sorghum silage, supported similar amounts of milk production. Cows consuming sorghum-based diets produced about 3.3 lb/day less milk than cows on other diets. Similar amounts of milk were produced on 31% and 35% NDF rations, but production decreased when cows received diets containing 39% NDF. Corn and alfalfa silage were used in a study by Purdue University workers to measure the performance of early lactation cows fed TMRs formulated to differ in NDF content by varying the amount of forage (silage) in the ration. The forage source used was a 50:50 mixture of corn and alfalfa silage at 41.2, 55.3, and 69.5% dry matter (DM) of diets containing 26, 31, and 36% of NDF. By-product feedstuffs are used extensively in dairy cattle diets

throughout the country. Frequently, these by-product feedstuffs are used as major sources of fiber or as fiber extenders in dairy cattle diets. While performance may remain good, the NDF content of the diet is sometimes higher than suggested (NRC publication, 1999) for high-producing cows. The problem can frequently be avoided by adjusting or discounting the NDF content of the by-product feedstuffs being used in the diets. First, although the potentially fermentable fiber content of many of these feeds is high, the rate of fiber digestion is slower than for most traditional forages. Secondly, the small particle size of many of these feeds and high- density results in a fast rate of passage, thus decreasing the time spent in the rumen. Thirdly, replacing traditional forage sources with fiber from non-forage sources may have further negative associative effects with other feeds. For example, soyhulls have high fiber content but their effective fiber content is low and thus cannot be used to replace large portions of dietary forage (Grant, 1997) [21]. The grinded conventional mixture is (Weidner and Grant, 1994) [39] replaced silages with 25% of soyhulls in a dairy diet and found that soyhulls decreased the dietary particle size by 33%, reduced ruminating time by half, and altered the consistency of the ruminal mat. In another study, Weidner and Grant (1994) [39] substituted soyhulls at 15 and 25% for forage (alfalfa and corn silage 1:1) which comprised 60% of the control TMR, DM for cows in early and mid-lactation. They found soyhull substitutions reduced cow performance unless coarsely chopped hay was added to the higher soyhull diet. From this study, previous reporters concluded that when high-quality forage is used to limit, the percentage of dietary NDF from forage can be successfully reduced to 45% with the inclusion of 25% soyhulls and 20% coarsely chopped alfalfa hay in the diet for lactating dairy cows. The maximum rate of inclusion of soyhulls for cows in mid to late lactation is about 20 to 25% of the total ration DM. Cows in early lactation (< 28 DIM) should probably not be fed soyhulls (Grant, 1997) [21]. So the current review on ration formulation of unconventional feed is very much essential to take a part in economic sources and industrial perspectives of Bangladesh.

Materials and methods

Feed that higher abdominal fat on a diet containing fat and suggested that it might affect the eviscerated yield of broilers. But when added 5% stabilized dietary animal fat for 10 broiler strains did not alter eviscerated yield. Using unconventional feed the carcass protein increased with increasing carcass fat and increasing dietary energy levels resulted in decreased carcass protein, but increased fatness. Here indicated that lean broilers produced by feed restriction during the last 12 days of the finishing period had a significantly higher proportion of breast meat and total meat in their carcasses than in birds fed (Allen, M. 1997) [3]. The higher proportion of meat and lower proportion of fat in carcasses of broilers on quantitative was administered in feed restriction. This indicated small differences in meat yield between lean and fat broilers mainly for higher breast meat in lean ones. That supplementation of diet with methionine (16% protein + 0. 1 methionine) increased fat and decreased protein content in breast meat. The experiment (Banaszkiewicz, 1999) reported no change in muscle and giblet proportion in carcass for the substitution of soybean meal by domestic protein in the diet. Local protein slightly increased the proportion of breast meat in a carcass. But, abdominal fat decreased on 75 and 100% of local protein products. Using Unconventional feed in Lactating dairy cows has obligate requirements for fiber to maintain normal rumination, chewing and saliva production, and normal ruminal function. The average milk yield per cow per day is 1.5 L for local and 2.5 L for crossbred (Saadullah, 2008), but they are bearing some characteristics as disease resistance, survive well in fluctuating nutrient supply and also suitable for hot humid climate condition of the Bangladesh. As per total milk production of the country is 0.939 million MT within this sheet supply, assumed 250g per day but availability of milk per head is only 379 (Saadullah, 2008). The most important animals are cattle and buffaloes, which provide the necessary draught power for ploughing, threshenint, sugarcane and oilseed crushing. It provides cash income through sale of live animals, milk, meat, eggs, skins, and hides wool as well as through hiring out of the draught animals.

Conventional feed

The feeds which are commonly used in ration formulation and established as constant feed is called Conventional feed. Examples of experimental reports were wheat, maize, rice polish, fish meal, vitamin and mineral premix, salt, synthetic amino acid, etc.

Unconventional feed

Some ingredients have potential but have not yet been explored in terms of chemical composition' proper feeding trial was completed and is not found available in the market. Examples: Marine waste, Shrimp waste, Duckweed, *Leucaena* leaves, mastered oil cake, coconut oil cake, oyster meat meal, Crabs meat meal, snail meat meal, sunflower seed meal, etc.

Duckweed

It is a good source of protein of vegetable origin. It contains 20-40% protein depending on its origin. Duckweed is a great source of carotene and xanthophylls and also a good source of lysine. It has 2000-2500 kcal energy on a dry basis. It can be used in 5% of the Poultry ration and 10% of the dairy ration.

Sesame oil cake

Good source of protein and a high source of maintenance and low in lysin, it does not contain substance toxic. It contains most of the essential amino acids at an adequate label. CF-8%, and lipids-8.7%.It contains inclusion levels of 10-20%.

Khesari

Khesari (*Lathyrus sativus*) is one of the protein supplements. It plays an important role in the nutrition of animals. The first experiment (Klimenko, 1956) concluded that as a practical fodder white vetch (*Lathyrus sativus*) contained a comparatively high percentage of proteins extractable by H20, Nacl, and alkaline solutions. All fractions contained amino acids possessing high feed values. The discussion on animal diets (Sastry *et al.*, 1961) with their chemical studies of *Lathyrus sativus* identified the amino acids such as cysteine, aspartic acid, glutamic acid, serine, glycine, L-alanine, and Leucine. The following experiment (Adamson *et al.*, 1985) conducted composition

as percent empty body weight as follows: Blood 4.3, 4.7; Skin + feet + head, 23.1, 24.4; empty gut 5.7, 8.3; Organs 6.1, 5.8; abdominal fat 5.4, 1.3 dressed carcass 55.3, 54.6 percent for groups A and B respectively expressed that concentrate feeding (supplementation) is one of the important factors which influence growth, carcass yield and meat quality in goats expressed that live weight at slaughter; hot carcass weight, and dressing percentage can be improved as much as 53.8, 79.3, 7.1 % respectively if proper nutrition is given to goats (NRC. 1989) [31]. The nutritional factors affecting growth and meat production have been studied in several breeds in several countries.

Blood meal cake

A blood meal is derived from grained and dried blood. It is a good source of protein and lysine.CP-80%, and inclusion level 3-4%.It is low in ISO-leucine.

Fish meal

Fish meal is made from the tissues of decomposed fish or fish cutting having no fish oil. It contains 60-70% CP (Crude protein), and good source of vitamin B-complex. In the case of Poultry, the level of the greater diet is 1%, and Dairy is 5%.

Results

The key to a successful feeding program for high-producing dairy cows is a balance between the needs for ruminal available protein, and carbohydrates that will optimize microbial growth and metabolism in the rumen (Cherney, DJR., and Lucey, RF, 1993) [12]. As these needs are met, fine-tuning the ratio with sources of bypass protein and fats may be advantageous. While the level of NSC needed in the ration will vary with forage type and use of byproducts feedstuffs, a suggested range is 35% to 45% NSC (Heinrichs, A J. *et al*, 1999) [26]. The lower ranges are recommended when rations contain good quality hay, and silage with natural grains such as corn and limited amounts of ingredients such as citrus pulp and soybean hulls.

Using adjusted NDF and NSC values for by-product feedstuffs will help to minimize the formulating problems attempting to use higher levels of by-product feedstuffs in the diet.

The results in Table 2 show a significant difference in DM (Dry matter) intake, milk yield, and fat-corrected milk (FCM) between the two lower NDF values 12% and 48% NDF. This is in contrast with studies that showed that 35% NDF diets performed equally as well as 42% NDF diets except in the silage diets. The differences are probably due to forage type since forages vary considerably in NDF content. In most forage-type rations, NDF values from 31% to 36% appear to be acceptable for high-producing cows (Oetzel, GR., 1996) [34]. In contrast, lactating cows appear to perform better on lower NDF rations when alfalfa hay and similar legumes are the major forage types (Beauchemin, K. *et al*, 1994) [11].

In diets for high-producing cows, the amount of fiber in the diet tends to decline as energy density increases. Rumen acidosis often occurs at insufficient amounts of total fiber or effective fiber in the diet. Guidelines and particle size separator boxes are available for use when balancing for effective fiber in diets using livestock production as unconventional feed. The rural people are rearing their cows using traditional method. They have very little knowledge about the scientific methods of' rearing cattle. They have no idea about optimum level of nutrition, disease control, proper housing, management practices, efficient reproductive performance, artificial insemination, veterinary services and well thought systematic programme etc. Animals are kept mainly in the stall with limited grazing on the road side; fallow land etc. and paddy straw are the staple food.

Formulating rations based on NDF values requires a good understanding of forage types and by-product feedstuffs (Armentano, L., and P. Clark. 1992) [4].The use of NDF values in formulating rations containing large amounts of byproducts, and discount values (Shaver, R. 1993) [35] should be applied to certain by-product feedstuffs such as distillers' grains, hominy feed, and soybean hulls. The case study was reported as a list of selected feedstuffs taken from the catalogs of different commercial producers of Bangladesh and conventional feedstuff of livestock farms. The enlisted nutrient ingredients showed the optimum levels of unconventional intakes for live stocks rather than conventional feeds. The physical form of a feed has a great impact on the effectiveness of the fiber in the diet provided by different companies. The combined ratio of unconventional supplements indicates the chewing time for certain feedstuffs. For example, the percentages of silica showed that long alfalfa hay containing 40% acid detergent fiber (ADF) was chewed at a higher rate of DM; than ground and pelleted hay or alfalfa hay (Firkins, JL. 1995) [16].

Discussion

Lactating dairy cows have obligate requirements for fiber to maintain normal rumination, chewing and saliva production, and normal ruminal function (Oetzel, GR., 1996) [34]. In diets for high-producing cows, the amount of fiber in the diet tends to decline as energy density increases. Rumen acidosis often occurs when there are insufficient amounts of total fiber or effective fiber in the diet. Guidelines and particle size separator boxes are available for use when balancing for effective fiber in diets (Stern, MD., and Zirmer, CJ. 1993) [38].

The up growing poultry farming of Bangladesh face the challenge on the supplementary feeding aims to make better use of this feed by supplying those nutrients that the pasture is deficient in, so that animals can be cheaply maintained while decisions are being made (Table 1, and 2).

Table 1: Nutritional characteristics are tabulated for the studies of good quality conventional vs. unconventional feed.

Contents	Conventional	Unconventional	Moderate feed
Moisture	High	Moderate to High	Low
Acidity	High	Moderate	Low
Buffering Capacity	Low to Moderate	High	Moderate to High
Bunk Stability	Low	Moderate to High	High
Starch	Moderate to High	Low	Low

Energy	High	Moderate to High	Moderate to High
Protein	Low	High	High
Macro-mineral	Low	High	High
ADF (Acid Detergent Fiber)	Low	Moderate	Moderate
NDF (Neutral Detergent Fiber)	Moderate	Moderate	Moderate
Effective Fiber	Low to Moderate	Moderate to High	High
Macro-mineral	Low	High	High

Table 2: The calculation of feed ingredients is tabulated for the feeding value of livestock's ration formulation.

Feed	DM (lb)		ADF (%)		ADF (lb)	DM (lb)		NDF (%)		NDF (lb)
Hay	18	x	31	=	5.6	18	x	42	=	7.6
Corn silage	10	x	26	=	2.6	10	x	48	=	4.8
Silage	15	x	3	=	0.5	15	x	9	=	1.4
SBM	5.8	x	10	=	0.6	5.8	x	12	=	0.7
Total	48.8		70		9.3	48.8		111		14.5
Mean	12.2		17.5		2.32	12.2		27.75		3.62
SD Values	4.67				2.06	4.67				2.76

Supplementary feeding is an option only when there is paddock feed available. When the availability of paddock feed becomes limited, survival feeding or production feeding must be implemented. 'Survival feeding' means providing an animal with the minimum feed it needs to stay alive; 'Production feeding' means, for adult stock, sufficient food for successful breeding or, for younger animals, sufficient food to meet growth and/or market targets (Table 3, and 4).

Table 3: Proposed ration formulation with unconventional feed mixing for broiler and layer birds

Ingredients	Quantity/ Unit	Starter (0-2wks)		Grower (3-4wks)		Finisher (4wks up to sale)	
		Formula-1	Formula-2	Formula-1	Formula-2	Formula-1	Formula-2
Maize	**Kg**	39.00	37.80	44.00	49.00	49.00	42.60
Wheat	Kg	-	10.00	-	-	-	09.00
Rice	Kg	10.00	10.00	-	10.00	-	10.00
Rice polish	Kg	14.00	-	14.00	-	09.00	-
Soybean meal	Kg	25.00	27.00	26.50	18.00	20.00	15.00
Coconut cake	Kg	-	-	-	-	05.00	-
Mustard cake	Kg	-	-	09.00	07.00	10.00	05.00
Meat & bone meal	Kg	08.50	10.00	-	10.00	-	08.00
Fish meal	Kg	08.50	10.00	-	10.00	-	08.00
Pam oil	Kg	04.50	05.00	05.00	05.00	06.00	06.00
Sesame (Til) cake	Kg	09.00	-	-	-	-	-
Lime stone	Kg	-	-	-	-	-	01.50
DCP	Kg	-	-	-	-	-	01.50
Common salt	g	350	350	350	350	350	350
Vitamin-mineral premix	g	350	350	300	300	250	250
Lysine	g	20	20	20	20	20	20
Methionine	g	10	10	15	15	15	15
Total		100	100	100	100	100	100

Table 4: Different unconventional feed ingredients enlisted from different companies in Bangladesh (Data were collected from the catalog of feed formulation, 2019)

Nutrients	New hope	Quality	Nourish	Kazi	C.P BD	Paragon	BRAC	Aftab
Mois %	11.81	9.82	9.67	10.90	12.72	11.28	9.79	10.24
CP %	21.18	24.41	24.42	23.89	23.90	23.04	23.91	22.11
Ash %	7.01	8.56	8.25	6.82	6.54	8.16	7.99	8.04
Ca %	1.14	1.28	1.16	1.05	1.08	1.14	1.25	0.86
P %	0.58	0.62	0.55	0.60	0.61	0.57	0.55	0.40
Silica %	0.55	0.55	0.50	0.57	0.56	0.57	0.54	0.55
Fat %	5.85	5.38	5.22	4.13	7.44	6.62	8.14	4.44

In case of poultry farming specially broilers and layers, these factors are interrelated. They are more efficiently absorbed if present in a certain ratio to each other. Higher levels of Phosphorus in relation to Ca content of the diet reduce the availability of Ca. Abundant amounts of vitamin-D in the diet reduce the importance of the ration in which Ca and P are present (Fig. 1). In the absence of the vitamin, Ca assimilation is poor even if the other two conditions are optimum. For optimum results, Ca and P content in the diet of growing chicken should be in the ratio of 1:1. Dietary Ca and P in the ratio of 2.5:1 may be tolerating by chickens without showing adverse effect. But a ratio of 3.3:1 is decidedly injurious. It produces leg abnormality and rickets (Fig 2). This demonstrated that long-time supplements of ingredients were a more effective source of fiber than pelleted alfalfa (Rippel, CE. and Stokes S. 1998) [36]. In

contrast, both minerals and fat stimulated the chewing time of DM which indicated equal effective fiber values than conventional feed citrus pulp12% and cottonseed hulls 43% (Heinrichs, A. J. 1996) [22]. In layer hen, egg size depend on diet mainly protein, energy and fat content of the diet. Feeding higher level of protein at the onset of production may help to increase egg size more rapidly (Fig. 3). The size of the eggs in relation to the period of egg production will determined the practicability of altering egg size. Smaller size eggs during the summer month are commonly the result of lower energy intake for high ambient temperature. The solid of egg albumin are almost entirely protein because the egg demands for protein are so great. Any lack of dietary protein results in a decreased in the amount of albumen and the egg size is smaller even though the quality of yolk is adequate. Fat effects on egg size due to high level of linoleic acid increasing early egg size. In case of energy it can observe large eggs contain more calories of energy than small eggs. The dietary energy required to produce them is greater. A hen needs 1.2% more feeds as egg size increases one ounce per dozen (Fig 4). So, excessively protein consumption increase egg size too much too little may result in an excessive number of medium size eggs.

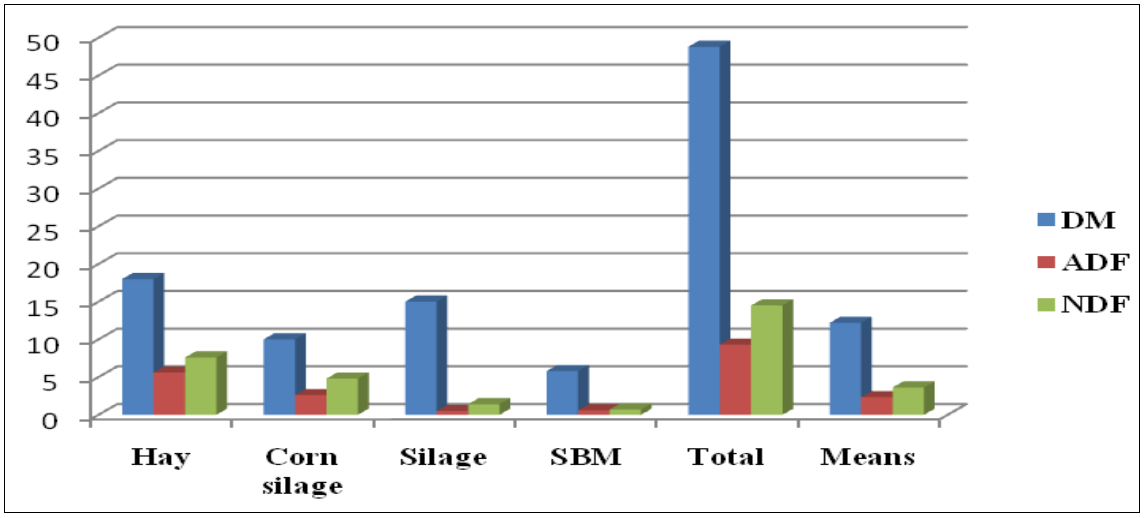

Fig 1: estimated values of feed ingredients for livestock's ration formulation.

Fig 2: (A) indicated the fewer amounts of CP% results ascitis in one week age of broiler chicks, **(B)** The photograph of healthy mammary glands showed the better status of udder health in cross breed dairy (HF) due to proper feed balanced supplements, and **(C)** The postmortem demonstrated the hemorrhagic blood on thigh due to Rickets of broiler chicken at four weeks age.

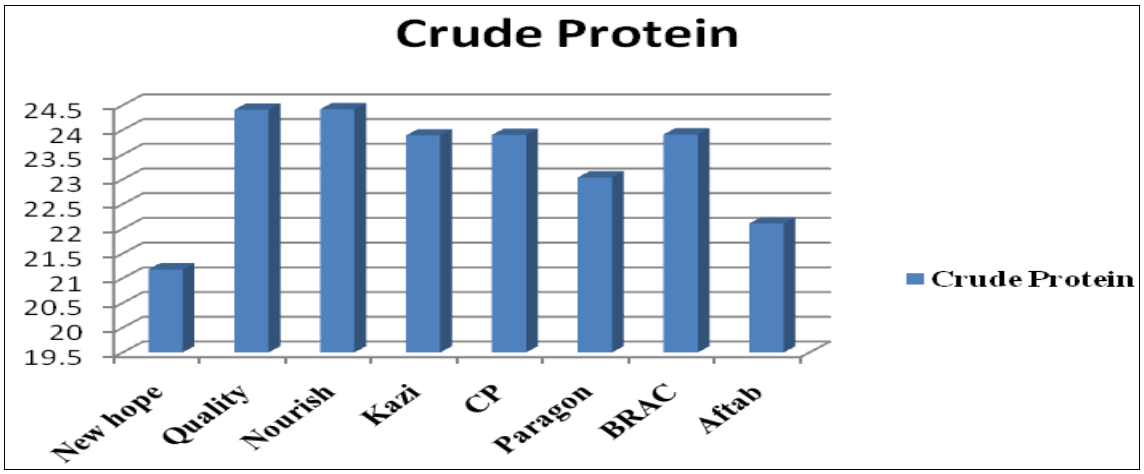

Fig 3: Crude protein percentages from different commercial feed companies in Bangladesh.

Fig 4: Photograph represented the increased egg production is 92% in sixteen months of layer hens using commercial formulation of unconventional feed in Bangladesh (Brown layer)

Conclusion

On the contrary of these topics, it can be concluded by the follow-up of using the unconventional feed proposed for poultry and cattle. Because Unconventional feed (what is analyzed for and usually balanced for) does not take into account particle size, the term "effective diet" has been used to better define the unconventional requirements of dairy cows. Effective unconventional feed stimulates rumination, chewing, and saliva production. It also maintains normal body growth, normal rumen pH, and normal rumen mat. Balancing diets for effective fiber becomes more important as cows increase their production levels and therefore require more concentration and less forage in their diets. The adequate effective feed may also be an issue in diets that are high in by-product feeds. Feeds with small particles usually are low in effective fiber. Values of effective means for some feeds are shown in as can been seen, feeds with high concentrations of NDF do not necessarily have a high effective fiber rating.

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