NIANP Technologies

An Overview

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NIANP

National Institute of
Animal Nutrition and Physiology

NIANP Technologies

An Overview

National Institute of Animal Nutrition and Physiology
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FOREWORD

Down the ages, livestock rearing has galvanized intimately with our ethnology. It is one of the stanchion of India's agrarian economy, food and nutritional security and livelihood. Its ownership is highly egalitarian, with proven growth accentuating poverty alleviation smarting the marginal and small farmers. This variegated paradigm of national livestock sector is proliferating vis-avis complying to the global dynamism of ushering socio-economic, environmental and technological forces. However, inherent issues of unbridled non-productive stock, infertility, marginal and crop residue based diet regime and trivial farm management standards have resulted in low productivity and endowments compared to global paradigm. To overcome this, urgent 'technological blitzkrieg' should be our key approach.

Being a premier ICAR institute, the 'National Institute of Animal Nutrition & Physiology' steers a continual expedition through basic and strategic exploration into the manifold dimensions of nutritional and physiological ambits of livestock production. Since its inception (1995 – 2011), the institute has evolved several technologies directed for livelihood empowerment. With a host of these technologies already commercialized, viable myriads remain for doorstep delivery. This archive compiles the salient principles, technologies formulated, products generated and their sequential dissemination to the stake holder. This document, asserts our efforts for its essentiality to policy planners, entrepreneurs, researchers, veterinarians and extension personnel, ushering national pride for the global metamorphosis of 'barrier-free' trade and 'climate-change'. All the contributors needs to be lauded for their efforts in bring out this document.

Prasad

(C.S. Prasad)

Dated the 19th July 2012
Bangalore

Index

Organic yeast chromium supplementation for stressed layer

Background

Stress is one of the major factors affecting livestock and poultry productivity. Losses resulting from stress could range from 15 to 20%. Currently, chromium is used as a feed supplement for alleviating thermal and vaccination stress. Since the bioavailability of inorganic chromium (chromium chloride) is limited, organic chromium has been tried to alleviate stress in poultry. Conversion of inorganic chromium to organic chromium would improve the bioavailability of the chromium. The Chromium complex with yeast exhibits higher biological activity. The organic chromium has several biological roles, the most important being enabling attachment of insulin to the insulin receptor. This enhances the entry of glucose into the cell and improve production.

The Technology

The Saccharomyces cerevisiae culture was grown in the laboratory and enriched with chromium. Chromium chloride was used in the culture medium for enriching chromium content in the Saccharomyces cerevisiae culture. The harvested culture was washed thoroughly to remove inorganic chromium and the presence of organic chromium was estimated. The chromium incorporation is directly proportional to the incubation time. Organic chromium content in yeast culture varied from 154 to 226 mg /kg of yeast. The chromium-enriched yeast was used for feeding of stressed birds to alleviate production loss due to stress.

Performance indicators

Conversion of inorganic chromium to organic chromium by means of

yeast incorporation is a useful technology. The chromium-enriched yeast is used in stressed laying bird to alleviate the production and disease related stress. It recovers the production back to normal condition within 2- 3 weeks and improves yolk colouration in the egg. Increased production during stress condition has high economical impact on the farmer.

The cost of production of chromium-enriched yeast is approximately Rs.800 per kg that can be supplemented to the birds through feed. The field level trial conducted with organic chromium exhibited positive response in alleviating stress in layers recovering from new castle disease. It was found that 400 ppb of the chromium is required to improve the egg production in disease condition. The technology is useful for laying birds suffering from environmental (summer stress) and disease stress.

Chromium supplemented Un supplemented

Changes in yolk colouration with chromium supplementation

Research Team

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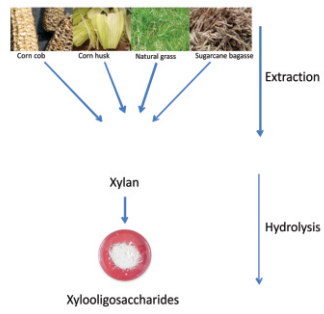
Production of nutraceuticals from agricultural byproducts

Background

Restrictions on the use of antibiotics as feed additives has put tremendous pressure on the livestock industry to guard the gastrointestinal tract from the harmful microflora using alternative measures. Prebiotics are the front-runner to occupy the space of antibiotics as the later is natural component and able to maintain the gastrointestinal health. An attempt was made to generate prebiotic xylooligosaccharides (XOS) from the abundantly available agricultural byproducts like corncobs, cornhusks, sugarcane bagasse and natural grass. The process begins with fractionation of the xylan using alkaline extraction coupled with steam application enabling 85 to 95% recovery of xylan content. The xylan is hydrolyzed enzymatically to yield xylooligosaccharides; which is further lypholized into white crystalline powder for use as nutraceuticals.

The Technology

The principal lies on the solubilization of xylan from agricultural byproducts in alkali medium followed by their recovery by alcohol precipitation. The xylan is the precursor of xylooligosaccharides. It is further hydrolyzed enzymatically in to xylooligosaccharides with low degree of polymerization viz. 2 - 3 (xylobiose and xylotriose). The advantage of the present process is higher recovery of xylan as compared to methods reported earlier. The hydrolysis conditions viz.; pH, temperature, reaction time, enzyme dose are also different from the existing methods.



Nutraceuticals form agro-industrial by products

Performance indicators

The cost of agricultural byproducts/ residues is meager as it is available abundantly. These are primarily fed to the livestock as basal roughages. On the other hand, presently prebiotics production relies on use of valuable crops like artichoke, chickory roots etc. Therefore, use of agricultural residues/ byproducts will be cost effective approach for production of nutraceuticals for use as feed additives/ nutraceuticals. As the prebiotics are derived from natural source, livestock industry will feel safe to address the consumer concerns regarding harmful residues of antibiotics in livestock products. Further the prebiotics also reduce blood glucose and triglyceride levels in the blood of broilers that enables greater acceptability to the health conscious customers. The process of XOS preparation is depicted below.

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Area specific mineral mixture for Karnataka

Background

Low reproductive efficiency in cattle and buffaloes is one of the major problems in Indian livestock, resulting in poor economic returns. The deficiency and/or imbalance of micro and macro nutrients is one of the important factors responsible for the low reproductive efficiency. As micronutrients are required in small quantities as compared to macronutrients they can be supplemented more easily without affecting the existing feeding practices. The practice of mineral supplementation to animals is not common in most parts of India. Wherever it is practiced, the mineral mixture is added to the compound feed without taking into account the mineral status of the area, leading to imbalances of minerals. Supplementation of area-specific minerals most deficient in that area avoids antagonistic effects of excess levels of other minerals, thereby improving the bioavailability of micronutrients and could be a more practical and cost effective approach. A detailed study on the micronutrient status of soil, water, feed fodder and blood of crossbred dairy animals maintained mostly under stall feeding with seasonal grazing was carried out in different agro-climatic zones of the country. The study on the mineral mapping of the state/India has revealed that the major deficiency is of calcium, phosphorus, copper and zinc in the different zones surveyed. Based on this information area-specific mineral mixture comprising of the most deficient minerals with common salt as base was prepared for different agro-climatic zones. The technology was field tested in adopted villages under Institute village linkage programme (IVLP). After detailed assessment of the mineral status in these villages area-specific mineral mixture was prepared and distributed to farmers having animals with reproductive problems like repeat breeding and anoestrus condition. The animals were supplemented with 35–40 g of mineral mixture per day mixed in either concentrate feed or home made concentrate mixture (bran, oilseed cake, gram husk).

Technical Features

Technology developed aims at correcting mineral imbalance in the animal body thereby improving reproductive efficiency and production.

As this technology aims at providing only most deficient micronutrients, it avoids antagonistic effects of excess levels of other minerals thereby improving the bioavailability of micro/macronutrients.

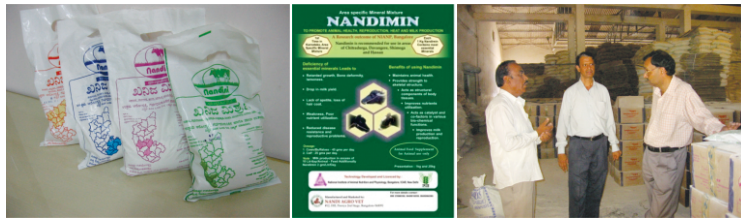
Technology is simple and cost effective for adoption at field level.

Technology does not have any adverse or side effects either on animals or on humans using animal products.

Performance Indicators

All the animals, which were fed the mineral mixture, showed improvement in health condition as perceived by the farmers and observed by the scientists in the form of body score and shine on the hair coat within 15 days of starting the supplementary feeding of mineral mixture.

In anestrus category 87.5 percent of animals started cycling within 40 days of feeding the mineral mixture. Some of the animals showed the symptoms of estrus within 15 days of feeding and 100 percent cycled after 70 days of the feeding.



Commercially available Area specific mineral mixture developed at NIANP

Similarly in post-partum anoestrus category 80 per cent of the animal stated cycling within 40 days of supplementation with the minerals mixture and rest of the animals cycled after 70 days of the supplementation.

Fifty five percent of the cattle having reproductive problem became pregnant within 70 days of the mineral mixture supplementation.

The results clearly showed that if only the mineral deficiency in animals is taken care of by supplementing mineral mixture and/or feeds rich in the

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Areca sheath as a dry fodder source

Background

In some regions of Karnataka, Kerala, Andaman and Nicobar islands and North-Eastern Regions particularly in coastal zone experiences deficit of dry fodder and paddy straw is imported from neighboring districts, thus resulting in higher feeding cost. Areca cultivation as a commercial crop is quite extensive in this region and there existed a possibility of using the fallen areca sheaths as a dry fodder for dairy animals. A technology was developed to use dried areca sheath in the form of total mixed ration (TMR) along with suitable proportion of concentrate to support milk production. This was also validated at farmers level. With the financial support of NABARD under rural innovation fund scheme, machinery required to process the areca sheath has been installed and commissioned in milk producers' cooperative society at Panaje near Puttur taluk of Dakshina Kannada district in Karnataka. Under the technical guidance of scientists of NIANP, the dairy farmers started using the processed areca sheath in the form of total mixed ration and the perception of farmers is highly encouraging in terms of milk yield and quality. There is a net saving of 50% in the cost towards dry fodder by using processed areca sheath as compared to paddy straw.

Technical features

The findings of this study indicated promising results that areca sheath is superior to paddy straw in terms of relatively low lignin(<3%), silica(<4%), higher energy (>50% TDN) and some minerals like calcium, sulphur and copper. Feeding areca sheath in sheep and dairy cattle showed that it can be a valuable dry fodder.

Performance Indicators

Dairy animals will find it difficult to eat areca sheath due to its shape and physical structure. To address the issue, separate machinery to chaff and

areca sheath chopping and grinding for feeding livestock

The results of this study indicated that the milk yield was similar in both the groups, where as the fat and SNF content were marginally higher in cows fed TMR prepared from areca sheath. No adverse effect was noticed due to feeding of areca sheath. Cows had a higher preference for areca sheath based TMR as compared to paddy straw. The farmer' perception was highly encouraging to use areca sheath as an alternative to paddy straw, which is scarce and costly in this region. There is a net saving of 50% cost in feeding of dry fodder by using areca sheath instead of paddy straw. In the present study as per the economics of feeding, there was a net saving of Rs. 14.4 per cow per day due to feeding of TMR with areca sheath.

Adoption and commercial production depends on many factors like region, quantity etc. For small unit of a processing capacity of 400 kg per day, Rs. 6.0 lakhs is required.

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Mineral mixture for small ruminants

Background

Commercial mineral mixtures comprising the essential minerals are available for large ruminants like cattle and buffalo. Although, small ruminants have specific mineral requirements which are quite different from the large ruminants, however specific mineral mixture formulations for small ruminants are commercially not available. Of late, sheep and goat rearing is becoming more intensive in some regions. Depending on the mineral requirement of sheep and goat, their feeding habits, mineral status of feeds and fodders used in feeding practice and most limiting minerals, specific mineral mixture formulations were made for sheep and goat. These formulations were tested in sheep and goat in organised farms and found to improve growth and health

Technical features

This mineral mixture is formulated based on the specific mineral requirement of sheep and goat. Antagonistic/synergistic action of individual minerals was considered while formulating specific mineral mixture. Accordingly, mineral mixture was formulated for sheep and goat to meet 100% requirement of most deficient trace minerals and partially meet the requirement of other minerals, with a consideration that remaining is to be met through feed and fodder. The synergistic action of calcium, phosphorus and antagonistic action of copper and sulfur were also considered, while formulating mineral mixture. The cost of this mineral mixture is lower as compared to that of conventional mineral mixture of large ruminants.

Performance indicators

Two organized sheep and goat farms were selected to test the efficacy of mineral mixture in sheep and goat. In Mr. Veerakempanna farm at Anur village, mineral mixture supplementation study was undertaken in sheep and goat. In Mr. Subba Reddy farm at Kaiwara village, mineral mixture

supplementation study in sheep was carried out. The lambs/kids at the age of about 4 months were used in the experiment. First group of animals were not supplemented mineral mixture and second group of animals were supplemented with 5 gm of mineral along with concentrate mixture. Initial and final body weights were recorded. In the experiment with sheep involving Rambouillet and Bannur lambs, an additional body weight gain of 17 and 7 gm/day/sheep was observed due to mineral mixture supplementation. Similarly, in the experiment with goats involving Sirohi kids, an additional body weight gain of 8 gm/day/goat was recorded due to mineral mixture supplementation. Also the immune status in lambs in terms of antibody titre against PPR vaccine and lymphocyte proliferation assay was higher in supplemented lambs.

Specific mineral mixture for sheep and goat developed at NIANP

For small unit of a processing capacity of 400 kg per day, Rs. 2.0 lakhs are required.

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SSF technology for bioconversion and nutritional up gradation of lignocelluloses for utilization as ruminant feed

Background

At present there is a sub-optimal utilization of the vast energy resources trapped in the poor quality crop residues, roughages and forages for livestock production due to the presence of strong ligno-cellulosic bonds. Chemical and biological processes have been tried with limited success. Fermentation with microorganisms has yielded success with mono-gastric animals but the few studies taken up in ruminants have provided inconsistent results. Solid State Fermentation is an important area of biotechnology on which great emphasis has been laid due to the innumerable benefits. Our research on SSF technology using aerobic fungi has proven it's role in improving the nutritional quality of poor quality crop residues, roughages and forages for ruminants. Once adopted it will increase the utilization of crop residues as livestock feed meeting the present shortage of feed resources thereby improving production

Technical features

The white rot fungi selectively degrade lignin leaving the energy from cellulose and hemi-cellulose fractions available for the animals. SSF straw fermented using white rot fungi is safe and can be directly used for feeding after fermentation for just five days. SSF has been tried out with a number of microorganisms for varied time durations without conclusive evidence for the high dry matter losses. By fermenting for just five days there is an increase in digestibility as well as the protein content (8-20%) with minimum loss in dry matter. SSF also results in improvement in palatability of dry roughages.

Performance Indicators

The technology involves the growth of white rot fungi on moist chaffed

ragi straw without any pretreatment for the prescribed duration in days at a particular moisture level, pH and temperature. Depending upon cost and availability several other straws /agro-industrial residues could also be used as substrate. The solid substrate not only supplies the nutrients to the microbial culture growing in it but also serves as an anchorage for the cells. The white rot fungi *Pleurotus ostreatus* and *Phanerochaete chrysosporium* have proved to be the most efficient in degrading lignin and enhancing in vitro dry matter digestibility by around 15 to 20 %. After fermentation the straw can be dried and used directly for feeding the animals. It will be possible to improve the nutritional quality of the available crop residues, forages and roughages

Solid state fermentation of ragi straw with white rot fungi

and increase their utilization for livestock production by making available the vast energy potential locked in their ligno-cellulosic bonds. Effective and complete utilization of these available feed resources for ruminants will increase productivity.

Applications

Biological pretreatments with microorganisms are well established in humans and monogastric animals. They enhance nutritive value as well as digestibility. They are economical and practical for large-scale fermentation of plant biomass as compared to other physical and chemical treatments. Unutilized crop residues are usually burnt adding to environmental pollution. One of the salient benefits with the use of SSF technology would be the complete tapping of the vast energy potential locked in the ligno-cellulosic bonds of the available crop residues, forages and roughages as animal feed.

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Production of lignolytic enzymes from Immobilized aerobic fungi

Background

The use of fungi and other organisms on straws has been used as an alternative to chemical and physical treatments to enhance straw quality for animal feed. Limiting amounts of lignocelluloytic enzymes are produced by white rot fungi, which impede their usage in animal feeds. The use of immobilized whole microbial cells and/or organelles eliminates the often tedious, time consuming, and expensive steps involved in isolation and purification of intracellular enzymes. It also tends to enhance the stability of the enzyme by retaining its natural catalytic surroundings during immobilization and subsequent continuous operation. There is considerable evidence to indicate that the bound-cell systems are far more tolerant to perturbations in the reaction environment and similarly less susceptible to toxic substances present in the liquid medium. The recent reports on higher retention of plasmid-bearing cells have further extended the scope of whole-cell immobilization to recombinant product formation. Another important advantage of immobilization, particularly in the case of plant cells, is the stimulation of secondary metabolite formation and elevated excretion of intracellular metabolites.

Lignolytic enzymes viz.laccase,LiP and MnP can be produced in bulk by immobilizing various white rot fungi on cheap inert matrices . Pretreatment of the crop residues with these lignolytic enzymes would help in lignin degradation and also that the incorporation of these enzymes in the diets of small ruminants will increase production. Effective and complete utilization of these available feed resources for ruminants will increase productivity.

Technical features

Cellulolytic and hemi-celluloytic enzymes produced through submerged fermentation and/or solid-state fermentation has been used in animal feeding. Lignolytic enzymes have not been produced for feeding ruminants for enhancing digestibility of crop residues. In solid-state fermentation the fungi produce a quantity of enzyme before it enters into the lag phase and stops enzyme production. In the present technology the fungi is immobilized on PUF cubes and kept alive by adding fresh media after every harvest for a period of up to 20 days duration. This way it is possible to enhance enzyme production by 3 to 8 fold. This enzyme rich media enhances digestibility when sprayed upon straw in the right ratio.

Performance Indicators

Feeding of the lignolytic enzyme treated ragi straw resulted increased daily weight gain (15%) in lambs dueing a 40 day feeding period. simultaneously, the dry matter intake and digestibility were also increased 4% and 7% respectively, in lambs when treated straw were fed.

Applications

Biological pretreatments with microorganisms are well established in humans and monogastric animals. They enhance nutritive value as well as

Production of lignolytic enzymes from immobilized fungi and treatment of ragi straw

digestibility. They are economical and practical for large-scale fermentation of plant biomass as compared to other physical and chemical treatments. Unutilized crop residues are usually burnt adding to environmental pollution. One of the salient benefits with the use of lignolytic enzymes by immobilization would be the complete tapping of the vast energy potential locked in the ligno-

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Chaffing of coarse roughages to reduce the energy expenditure in ruminants

Background

Time that ruminant spends for eating and ruminating amounts to 13 to 17 h/d when animals are given *ad libitum* access to diets that contain a high proportion of roughage. The capacity of ruminants for mechanically reducing feed particle size could be a limiting factor for feed intake. In addition, the energy requirement for chewing accounts for a considerable proportion of the total energy requirement. In low- quality roughages (like paddy straw), the energy requirement for eating could amount to substantial proportion of the metabolizable energy (ME). Energy needed for chewing thus reduces the amount of ME available for production, and this could have a substantial effect on productivity, particularly at low levels of production in tropical countries like India. In large parts of southern India, un-chopped dry roughage is offered to the ruminants. Although some chewing and rumination is essentially required for proper mixing of the saliva with the feed particles, in addition to reducing the particle size, excessive chewing and rumination needs extra energy expenditure, resulting in wastage of biological energy. Chaffing is the simplest and easiest process for reduction of particle size of roughages. Systematic studies carried out has established that chaffing of low quality roughages has definite advantage in terms of not only increasing the DM intake by decreasing the time taken for ingestion but also in reducing the energy spent on chewing in ruminants. Results have established that ruminants spend only 44.0 per cent of the ingested energy in chewing chaffed paddy straw as against 50.0 per cent when fed un-chaffed, a net saving of 6 percent of the biological energy.

Technical Features

The length of the coarse roughages such as paddy straw and wheat straw is about 2.5-3.0 ft depending upon on the variety. These coarse roughages could be chaffed using a mechanical or electrically operated chaff cutter to less than 2.0" and fed to the animals. By chaffing, the wastage of the materials by selective refusal is also avoided.

Conventionally in large parts of southern India, un-chopped dry roughage is offered to the ruminants. The activity of various muscles involved in chewing activity and rumination is a potential mechanism to reduce the

particle size of feed to the threshold size which, for cattle is around 1.0-1.18 mm. By feeding the roughages after chaffing, apart from increasing the DM intake the potential wastage of precious biological energy in chewing the roughage could be reduced. This saved energy would be used for productive purposes in ruminants like growth and milk production. It is also established that the fermentation process in the rumen improves by feeding chaffed straw instead of un-chaffed.

Performance Indicators

One of the salient benefits with the use of this technology could be reducing the greenhouse gas emission in ruminants. It is well established that ruminants fed on roughage-based diets produce more methane due to the fermentation resulting in higher acetate production. However, by chaffing the coarse roughage due to increased DM intake, the rate of passage will be more in the rumen resulting in less methanogenesis. This will help in not only saving the biological energy but also preventing the global warming due to its greenhouse effect.

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Enteric methane reduction using plant secondary metabolites

Background

Methane accounts for 2-12 % loss of dietary gross energy in ruminants and is a potent greenhouse gas with a global warming potential 23 times higher than that of carbon dioxide. Therefore reducing ruminal methane not only improves the efficiency of nutrient utilization but also helps to protect the environment from warming. Manipulating the rumen microbial ecosystem to reduce methane emission and N excretion by ruminants to improve their performance are important issues for animal nutritionists. There is a need for identifying feed additives with potential to modify rumen fermentation thereby enhancing the efficiency of utilization of feed energy while decreasing rumen methanogenesis.

Technical Features

Plant secondary metabolites such as tannins as rumen modifiers are potential candidates since these compounds are natural products which are environmental friendly and therefore have a better acceptance with regard to food safety issues. Few tropical leaves containing-tannin that have the potential to suppress enteric methanogensis without any adverse effect on the rumen fermentation pattern have been identified. Feeding the ruminants with complete feed blocks containing optimum level of tree leaves would help to suppress rumen methanogenesis and improve the productive performance.

This technology when used not only saves the biological energy in the form of methane but also prevents the global warming.

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Simplified Azolla production method

Background

Azolla, a free floating water fern, is a popular bio-fertiliser. The blue green algae grow in association with this fern. Azolla has triangular or polygonal fronds. The main stem grows at the surface of water, with alternate leaves and adventitious roots at regular intervals along the stem. Due to its higher crude protein content (over 20%) than most green forage crops and a favorable amino acid composition (rich in lysine) for animal nutrition, it has also caught attention of livestock, poultry and fish farmers. The growing popularity of azolla as livestock feed supplement is because it is easy to cultivate with high productivity. It is rich in protein, essential amino acids, vitamin A and B12 and minerals.

Technical Features

For small holders, a minimum pond size of 6 X 4 feet is made with durable plastic sheet like UV stabilized silpaulin, and side walls of bricks or excavated soil for Azolla cultivation is sufficient to produce about 800 grams of supplemental feed per day. Old gunny bags are placed on the floor of the pond to prevent damage to silpaulin sheet and to improve the durability. Two Kg of sieved fertile soil and one Kg of cow dung are mixed with water to make slurry and it need to be spread uniformly in the pond. About one kilogram of fresh Azolla culture is needed for a pond of 6 X 4 feet size. It has to be applied uniformly in the pond. The depth of water should be maintained at four to six inches through periodical addition of water. After the inoculation of culture, the pond needs to be covered with a net to provide partial shade and also, to prevent the fall of leaves and other debris into the pond. Thin wooden poles or bamboo sticks are to be placed over the pond walls to support the shade net. During the monsoon season, if rainwater can be harvested from the rooftops and used for cultivation of Azolla, it will ensure excellent and faster growth of

Azolla. Application of one kg of cow dung and 100 grams of super phosphate once in two weeks will ensure better growth of Azolla. Any litter or aquatic weeds seen in the pond should be removed regularly. The pond needs to be emptied once in six months and cultivation has to be restarted with fresh Azolla culture and soil. Depending on the initial quantity of culture added,

Production of azolla for feeding livestock

environmental conditions and nutrition, Azolla 's growth in the pond will be complete in about two to three weeks time. It can be harvested daily after the full growth. Plastic sieves can be used to take out Azolla biomass from the pond's surface.

Performance indicators

In the studies with over 100 dairy farmers done at various villages of Chitradurga district of Karnataka, feeding of Azolla @ 800/- grams (fresh weight) on an average per day, improved the monthly milk yield by at least 10 liters per cow. With a 6 X 4 feet pond, the farmer can easily make a net profit of over Rs.1,400 per year from the additional milk yield from single milch animal. This simplified production technology is economical and very easy to use.

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Detoxified Karanja and Neem seed cake as a replacement of Soybean Meal for sheep

Background

Protein is one of the major limiting nutrients in the rations of Indian Livestock. A large quantity of protein rich nonconventional oil cakes are underutilized due to the presence of anti-nutritional factors and absence of commercially viable technology of detoxification. In the present technology two important unconventional oil cakes Karanja (Pongamia pinnata) and Neem (Azadirachta indica) which are being used as agro-wastes (manure) were used as major protein supplements to spare the standard soybean meal. Karanja (Pongamia pinnata) is a forest tree belonging to the family Leguminosae, grown in all parts of India, particularly in Tamil Nadu, Andhra Pradesh and Karnataka, for its ecological advantages. The potential availability is to the tune of 0.15 million tons. Similarly, Neem (Azadirachta indica) trees are abundantly available and seed cake is available to the tune of 0.5 million tons. The detoxified cakes were used in concentrate mixtures as a replacement of soybean meal. Long term feeding trials (Two independent trials) were carried out in male sheep after detoxification. Various performance indicators were taken into consideration for validation of technology. The indicators taken are growth performance, blood biochemical and enzyme profile, rumen fermentation pattern, immunity status, nutrient digestibilities, physico-chemical carcass characteristics including organoleptic attributes and gross and histo- pathological changes in vital organs. After taking into consideration of all the indicators it was recommended to include the detoxified karanja and neem cake in the concentrate mixture by replacing 50% soybean meal on nitrogen basis. On practical terms, detoxified karanja and neem can be added in the concentrate mixture up to 18 and 11 per cent, respectively.

Technical Features

In animal nutrition studies, soybean meal is considered as standard protein supplement and has good amino acid composition. Test protein supplements viz. Karanja and Neem have been included in the concentrate mixture and compared with soybean meal containing concentrate mixture. One more important feature of the technology is that the feeds have been tested in growing lambs to get exact effect of protein supplements on growing animals. Animals have been evaluated on the basis of its exerted effects on growth rate, nutrient digestibility, immunity status, histopathological changes and meat quality evaluation including chemical and organoleptic attributes. Technology is highly suitable for industry as individual farmers will not be able to process large quantities of seeds for detoxification. Even byproducts available in this technology can also be used indirectly in biofuel, biopesticide, soap industry or even medicinal preparations. For detoxification, the seeds were dehulled and kernels were separated (in case of neem), crushed and defatted to remove oil. Defatted cake was refluxed with organic solvants. The detoxified cake were evaluated in growing lambs. Detoxified karanja cake had a CP of 37 % where as neem cake had 50 %. Animals were evaluated on the basis of its exerted effects on growth rate, nutrient digestibility, immunity status, histopathology, meat quality evaluation including chemical and organoleptic attributes.

Detoxified karanja and neem seed cake

Applications

Large scale uninhibited use of detoxified nonconventional protein rich feeds will enhance the animal feed basket by providing economic, wholesome, nutritious components of animal feed formulation from hitherto under-utilized sources and substitute scarce conventional oilcakes besides providing value addition to non-traditional oil cakes.

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Combination tests for identifying sub-fertile semen

Background

Conventional semen analyses fail to predict fertility in a given semen sample. In this regard, a combination of test hypo-osmotic swelling-Giemsa (HOS-G) test has been developed. In this technique, the independence of different plasma membrane regions surrounding the spermatozoa has been observed. As a result, multiple variables are examined in the single spermatozoa to determine fertility. The sperm functional membrane integrity and acrosomal integrities were estimated in spermatozoa. This test is found to have strong correlation with in vitro (r=0.9) as well as in vivo (r=0.6) fertilization capability. If spermatozoon is positive for both these attributes, it is possible that the sperm can reach the site of fertilization and penetrate through zona pellucida and this can be used to assess sperm fertility at the field levels.

Using this method, selection of breeding bulls is possible and the semen can be evaluated before freezing. This method can be included as post thaw spermatozoa function test and used to eliminate infertile or subfertile bulls and help to improve field fertility of frozen semen.

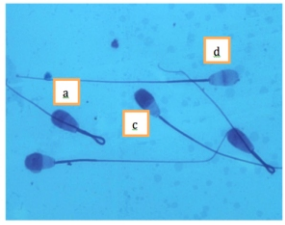
Technical Features

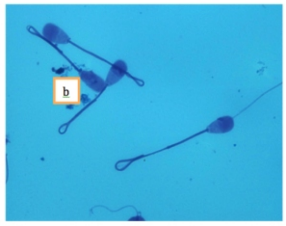
The emphasis now is focused on analyses that incorporate multiple variables to examine the contribution of different sperm parameters to determine fertility. In this direction, sperm functional membrane integrity and acrosomal integrities were estimated in spermatozoa using hypo-osmotic swelling-Giemsa (HOS-G) test.

Assessment of plasmalemma characteristics is useful for predicting the fertilizing ability of sperm. Sperm plasmalemma integrity is essential for sperm metabolism, capacitation, ova binding and acrosome reaction. Various tests being done to evaluate sperm plasmalemma include permeability to stains

and biochemical function. Sperm membrane functional status is essential since an intact and functionally active membrane is required for metabolism, capacitation and acrosome reaction attachment and penetration of the oocyte.

Hypo-osmotic swelling test (HOST) is simple and inexpensive and proven to be useful in predicting the spermatozoa ability to fertilize. Evaluation of acrosomal status is very important because it is directly correlated with the fertilizing capacity. Using a stain that will differentiate acrosomal status as well as living from nonliving cells makes it possible to distinguish true acrosome reacted sperm and to predict fertility. Although





a: Spermatozoa subpopulation positive for HOS-G test (Positive for both functional membrane integrity and acrosomal integrity)

b: Spermatozoa subpopulation negative for the HOS-G test (Positive for only functional membrane integrity and negative acrosomal integrity)

c: Spermatozoa subpopulation negative for HOS-G test (Negative for both functional membrane integrity and positive for acrosomal integrity)

d: Spermatozoa subpopulation negative for HOS-G test (negative for both functional membrane integrity and acrosomal integrity)

maximum limit for acrosome alterations is not fixed, it is reported that the samples should not contain more than 40% of spermatozoa with acrosomal alterations.

It is reported that loss of the sperm plasma membrane integrity is frequently associated with infertility in males, despite normal semen parameters. The HOS-G test to evaluate the functional sperm membrane integrity along with acrosomal integrity appears to give high repeatability and accuracy. This test was suggested to be a useful addition to the standard semen analysis. It is clear that measures of single sperm traits, or the results of single functional tests, are poorly correlated with fertility.

Applications

The technology helps to predict fertility of a semen sample and eliminate infertile semen being processed. Hence the users like semen bank will produce good quality semen samples for field insemination. The technique is simple, can be done with basic chemicals and fluorescent microscope. This will also be an economical and easy to use in the field condition.

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Red Spectrum of light improves egg production

Background

Poultry starts reproductive development after sensing an increase in day length. This happens when more light is absorbed by a portion of the brain called hypothalamus, which secretes hormones and controls the part of the nervous system responsible for regulating automatic body functions such as temperature, blood pressure, thirst, hunger and sleep-wake cycle. Because blind birds lack the retina response that inhibits reproduction, they experience only the stimulatory influence on the hypothalamus, which encourages them to laying eggs earlier. Hen's egg laying activity is regulated by two light pathways, an inhibitory pathway that is activiated by stimulating retinal photoreceptors by the incandescent band of the spectrum and the stimulatory pathway is activated by the direct of the red band on the photoreceptors in the brain. The red light spectra can increase the reproductive performance. The technology can be adopted with little modification in the existing managemental practices.

Technical features

Exposure of birds to red spectrum of light during night in place of normal incandescent light triggers the reproductive performance of the birds thus, lay more eggs with available resources under normal husbandry conditions. Experiments were conducted twice in our poultry farms and results were promising. Red spectrum of light improved egg production by 8.5 %. The other benefits observed were uniformity in lighting, reduced feed intake, decreased aggression in the birds and feather pecking. Mortality in the treatment group was also lower.

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Probiotics for improved growth

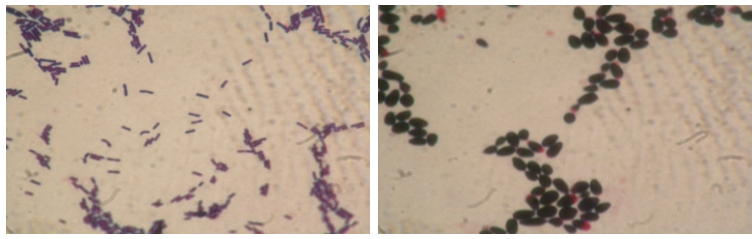
Background

Probiotics are beneficial microbes inhabiting the gastrointestinal tract of all the animals including human beings. They help the host animals in various ways viz. exclude pathogenic organisms, improves immunity of the host, improves nutrient absorption and utilization and also contributes valuable metabolites and enzymes to the host. For a probiotics to be effective, the organism has to be: closely related, adequate dose of the organisms need to be administered, the organism has to survive and establish in the digestive tract. The suitability of the organism should be pretested on the probiotic criteria viz. tolerance to variable pH, higher bile salt, pathogen exclusion and effect on IVDMD. Use of probiotics has been gaining prominence in human nutrition during last few years. It is green technology and its also environment and user friendly. Use of probiotics in livestock could also improve growth in young animals besides improving immunity.

Technical features

Out of 110 cultures and isolates, 5 isolates were selected by screening on probiotics crieteria viz. pH and high bile salt tolerance, pathogen exclusion and improvement on IVDMD. The selected organisms were identified using morphology and biochemical tests and reconfirmed for their identity using 16sRNA partial gene sequence. These organisms were *Enterococus faecium, Enterococcus fecalis and Bacillus subtilis, Micrococus varians and Lactobacillus maltromicus.* A daily dose of 10^9 cfu /kg of *E.fecalis* over 142 days in the lambs recorded 43.3g/d ADG as against 36.6g in control group. No difference was observed in dry matter intake (445-496 g/day) and digestibility(70-73%) but, bacterial and protozoal counts were greater in probiotic supplemented adult sheep.

Use of probiotics recorded higher ADG as compared to control over a period of 4 months of feeding. Use of probiotics reduces the use of antibiotics in livestock rearing. Probiotics use is a green technology and has no ill effect on the environment. Use of probiotics would increase growth rate of young animals, which would lead to early sexual maturity, and early attainment of marketable weight. The technology would result in to improved profit from livestock rearing.



Lactic acid bacteria *Bacillus subtilis* and *Enterococcus faecalis*

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Maize cob based complete feed block

Background

There are several feed resources which are not utilized to their full extent as animal feed. The nature of some feeds creates hindrance in their optimal utilization for the purpose of feeding to livestock. Some feed resources are low in nutrients; some are low in bulk density and still few other pose difficulty in their processing. Maize cob is such a material. Though it's rich in soluble sugars, fiber and minerals it is not used as a feed ingredient. Rather it's used for burning or wasted in the field. In this technology grounded maize cob as roughage along with concentrate mixture (50 :50) were used to develop a complete feed block. This technology device a better use of the maize cobs which otherwise are wasted.

Technical features

The dried maize cobs are manually broken down to 1-1.5 inch size. Thereafter, these maize cob grits are mechanically grounded to 5-8mm size using a roughage grinder. A balanced concentrate mixture having 18-20% CP and 75% TDN is made using Maize grain, Soybean Meal, GNC, Rice Bran, Mineral Mixture and common salt. Grounded maize cobs and concentrate mixture are mixed in a ratio of 50:50 and subjected to 3000-psi pressure in the feed block machine to make feed blocks. These feed blocks offer a complete balanced feeding option to the livestock. Besides a feed block could be easily stored and transported. The technology was evaluated in a feeding trial with lambs. In lambs, 0, 50 or 100% ragi straw was replaced with grounded maize cobs in the 50 :50 ragi: concentrate ration. It was observed at the DM intake varied from 518-558 g/day and DM digestibility varied from

Feed blocks prepared by using maize cobs

61-64%. In addition, higher bacterial and fungal populations were recorded in maize cob fed groups.

Use of maize cobs for feeding purpose would reduce organic wastage of this resource and also reduce environment pollution. It could make more efficient use of available feed resources. Use of maize cobs could reduce feeding cost of dairy animals.

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Production of low cholesterol eggs

Background

Since ancient time, garlic has been used as a therapeutic agent against many diseases. Garlic has been traditionally used to treat cardiac disease due to its hypocholesterolemic effect in human. Studies in animals indicate that garlic has potential hypolipidemic, hypotensive, hypoglycemic, hypothrombotic and hypoatherogenic properties. It is a natural antioxidant. Feeding garlic has resulted in higher plasma uric acid levels in layer birds. Further there is an enhanced activity of various anti oxidant enzyme levels like super oxide dismutase, catalase in plasma profile of the layer birds. Fatty degeneration in the liver was reduced to a greater extent in birds fed with garlic as against control birds. Investigation on the potential effect of dietary garlic supplementation in poultry has revealed that it can reduce serum and yolk cholesterol concentrations without any adverse effects on layer performance.

Technical Features

The consumption of egg has become a concern due to the content of cholesterol in yolk. Various natural substrates including garlic are recommended as a cholesterol lowering agent. In rat, dietary supplementation of garlic reduces plasma cholesterol and, hepatic total lipid and cholesterol. Garlic extract reduces serum cholesterol level in poultry by inhibiting enzymes involved in cholesterol and lipid synthesis. The level of egg yolk cholesterol can be reduced through the dietary supplementation of garlic. It can alter the lipid metabolism in layer birds in a favorable way resulting in the production of eggs with lower levels of yolk cholesterol and triglycerides. Moreover, the dietary garlic supplementation can increase the egg production performance of layers.

Performance indicator

Feeding of garlic @ of 1% in the feed will result in production of eggs with lower cholesterol (10%) and triglycerides (23%) compared to regular eggs. Further feeding of garlic form 50th week of egg lay will result in 1.5-1.8% higher hen day egg production.

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Strategic supplementation of limiting nutrients

Background

In India, crop residues continue to be the major source of roughage for feeding dairy animals. Because of its low nutritive value, several methods have been tried to improve the digestibility of crop residues, but met with limited success because of the cost factor involved in the treatment or its field adoption and was found little acceptance by the farmers. One of the alternative methods left is to refine the existing feeding practices/technology followed by the farmers by strategic supplementation of limiting nutrients through locally available feeds without altering much in the existing feeding practices, so as to easily acceptable to the farmers. Any improvement in its nutrient digestibility through supplementation would help in reducing the cost of milk production. Therefore, the milk production performance in dairy animals could be improved by strategic supplementation of limiting nutrients such as energy through cost effective supplements using locally available feed ingredients.

Technical features

The nutritional status of the animals in the two villages was assessed. Farmers were feeding supplements such as GNC and wheat bran along with basal diet comprising of finger millet straw (FMS), maize fodder and mixed local grass. The ration fed to the animals by the farmers was deficient in energy. Therefore, after assessing the nutritional status of the animals it was observed that milch animals were not fed as per their production potential and needs to be supplimented more energy for increased milk production. The farmers were feeding wheat bran (WB) as energy source. WB which was used as a energy source was found to be more expensive in these areas as compared to maize grain. The maize is good natural source of energy. Hence approximately 50% WB was replaced with maize grain. It was observed that

by adopting this simple modification in the feeding, the milk yield of the cows increased by 1.0-1.2 liters per day. The feed cost was reduced by Rs 2.70 to 3.60 per day per cow and the farmers income was increased by Rs 13.00 to Rs 15.00 per cow per day.

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Urea treatment of paddy and finger millet straw as a feed form livestock

Background

In India, crop residues continue to be the major source of roughage for feeding dairy animals. They are low in nutritive value, deficient in protein and energy, and high in fibre. By urea treatment of straws the protein content could be improved thereby the digestibility of straws for improved milk production in cattle.

Technical Features

Paddy straw and finger millet straw were taken from the farmers fields and treated with urea and stored in plastic bags / pits. The straw was then taken out after 21 days and fed to the animals. Use of plastic / gunny bags for storing the treated straw for 21 days was useful for farmers who were not able to make pits for urea treatment. Moreover, the treatment could be done as and when needed in a planned way so that the animals were never short of feed in the form of urea treated straw. The farmers also found that the cost of feeding was also reduced.

The advantages of urea treatment of paddy straw and finger millet straw is increased intake and reduced wastage of treated straw coupled with increased milk yield to the tune of 0.5- 0.75 litres. It is a cost effective technology and has the potential for use under different farming systems.

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Bypass protein feeding

Background

The protein fed to ruminants is degraded to ammonia in the rumen and becomes a source of nitrogen for microbial protein synthesis. The microbial protein synthesized in the rumen is digested in the abomasum and small intestine. The dietary proteins, which reach the lower tract without getting degraded in the rumen, are called “bypass proteins”. In case of high / medium yielding animals, the microbial proteins synthesized in the rumen may not be sufficient to meet the protein requirement of the animals. Therefore, it is desirable to incorporate the protein sources, which provide the bypass protein in the concentrate mixtures, especially during the early lactation for increased gain, reproduction and milk yield in dairy animals.

Technical Features

The nutritional status of the animals in the two villages was assessed. Farmers were feeding supplements such as GNC and wheat bran along with basal diet comprising of finger millet straw (FMS), maize fodder and mixed local grass. The farmers were feeding higher protein, which was highly degradable. GNC, which was used as a protein source, was found to be more expensive in these areas as compared to cottonseed extraction (CSE). The CSE is good natural source of bypass protein. Hence an attempt was made to replace approximately 50% GNC in the farmers feeding practice with cottonseed extraction and to demonstrate the beneficial effect of feeding bypass protein through cottonseed extraction to lactating animals. The milk yield of supplemented cows was increased by 1.2-1.7 liters per cow per day. The feed cost was reduced by Rs 0.81 to 3.90 and the farmer's income was increased approximately by Rs 15.80 to Rs 17.81 per cow per day.

Crude protein (CP), Rumen degradable protein (RDP) and undegradable protein (UDP) / bypass protein content of feeds and fodders

Feedstuffs	CP	RDP	UDP (bypass protein)
	gram per kg dry matter		
Concentrates			
Bajra	120	38	82
Barley	100	79	21
Brewers grains	260	122	138
Coconut cake (solvent extracted)	270	62	208
Coconut cake (expeller)	240	173	67
Corn gluten meal (60% CP)	600	126	474
Corn gluten meal (40% CP)	400	148	252
Cotton seed	170	78	92
Cotton seed cake	350	179	171
Cotton seed cake (solvent extracted)	360	137	223
Distillers dried grain	290	133	157
Gingelly / sesame / til cake	350	266	84
Groundnut cake (expellar)	450	315	135
Groundnut cake (Formaldehyde treated 1g/100g CP)	450	194	256
Groundnut cake (Heat treated 130º C 3 Hrs)	450	194	256
Groundnut cake (Heat treated 130º C 2 Hrs)	450	234	216
Groundnut cake (Deoiled / solvent extracted)	480	408	72
Horse gram	240	137	103
Jowar	100	20	80
Karanja cake	320	173	147
Kokam cake	140	17	123

Feedstuffs	CP	RDP	UDP (bypass protein)
	gram per kg dry matter		
Linseed cake	280	162	118
Mahua seed cake	185	105	80
Maize bran	160	59	101
Maize grain	90	27	67
Mustard cake	350	263	87
Neem seed kernel cake	386	217	169
Niger cake	330	244	86
Oats	100	84	16
Rice bran	140	91	49
Rice bran extraction	160	64	96
Rice broken	110	35	75
Rice polish	120	61	59
Rubber seed cake	280	202	78
Safflower cake	220	141	79
Salseed meal	90	27	63
Silk cotton seed cake	370	289	81
Soyabean meal extractions	460	276	184
Sunflower meal	300	165	135
Roughages			
Alfalfa, dehydrated	200	80	120
Alfalfa fresh (*Medicago sativa*)	200	152	48
Berseem *(Trifolium alexndrium*)	259	127	132
Grass hay	29	13	16
Guninea grass	82	33	49
Maize early cut	165	96	69
Oats (*Avena Sativa*)	126	65	61
Para grass	71	34	37
Rice straw	40	15	25
Subabul *(Leucaena leucocephola*)	250	80	170
Sugar cane tops, chaffed, ensiled	68	10	58
Wheat straw	33	18	15

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