**ANIMAL NUTRITION**

**NON- CONVENTIONAL FEEDS, THEIR ANTI-METABOLITES AND TOXIC PRINCIPLES**

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**Key points:**

* Non-conventional feed resources (NCFRs) are alternative sources of used for feeding animals.
* NCFR includes traditionally unused feeds, such as agricultural and industrial byproducts and wastes.
* They are mainly organic in nature.
* Agar-agar is extracted from Sargussam sea weed.
* Tankage- It is a fat free product obtained by cooking of meat in water.
* Pressmud-is a byproduct of sugar industry during precipitation. It can be utilized as mineral supplement for large ruminants.
* Suitability for feeding NCFRs depends on factors like palatability, nutritional value, and consideration of toxic/anti-nutritional factors (ANFs)
* Duckweed is a valuable non-conventional feed resource known for its high protein content.
* **Classification of non-conventional feed resources:**

|  |  |  |
| --- | --- | --- |
| **Energy Sources** | **Protein Sources** | **Other miscellaneous** |
| Tapioca waste/Cassava waste, salseed meal, deoiled salseed meal, mango seed kernel, tamarind seed, tamarind seed kernel, tamarind. | Castor bean, ambadi cake, castor beans meal, neem seed cake, guar meal, niger cake, karanj cake, rubber seed cake, kapok seed cake, sunnhemp seed, daicha seed, cassia tora seed, mahuaseed cake, tobacco seed cake, water dammar seed cake, bijada cake, watermelon seed cake, safflower seed cake, spent coffee seed cake | Babul pods, Jackfruit waste, Seaweed meal, sugarcane baggage, sugarcane tops,  **Brewery waste**: Brewer’s grains left after extraction of malt  **Fruit and vegetable factory byproducts:**  **Agro-industrial byproducts**:  **Poultry industry byproducts**: Feather meal, offal meal, hatchery waste  **Slaughterhouse byproducts**: Blood meal, meat meal, meat and bone meal, Tankage, Rumen contents  **Animal waste:** Animal organic waste, animal byproduct waste, abattoir waste |

* Antinutritional factors (ANFs) in NCFRs hinder feed utilisation, diminish production, or impact animal health.
* Protease inhibitors include Kunitz and Bowman-birk inhibitors.
* HCN binds with carbohydrate moieties like mannose.
* Poultry are more susceptible to saponin toxicity than pigs.
* Cyanogenic glycosides undergo conversion into Purrisic acid and hydrocyanogen
* Ruminants are more prone to HCN poisoning than horses and pigs. Among ruminants, cattle are more susceptible to HCN poisoning than sheep.
* Tannins are high molecular weight polyphenolic compounds. There are 2 types of tannins namely, hydrolysable and condensed tannins. Hydrolyzable tannins pose greater threat to animals as compared to condensed tannins. Condensed tannin help in by passing of proteins from the rumen.
* Hydrosable tannin yields gallotannins and ellagitannins. Condensed tannins are flavonoid-polymers of flavanol.
* Detannification involves the removal or inactivation of tannins in feed. PEG and PVP serve as tannin complexing agents.
* Tannins are biodegraded by white rot fungi like *Sporotricum pulverulentum, Ceriporiopsis subvermispora and Cyathus steroreus*.
* Tannins, found in some non-conventional feeds, can bind to proteins and reduce their digestibility.
* Phytic acid is chemically known as inositol hexaphosphatase.
* Ruminants are less susceptible to glucosinolate toxicity compared to pigs and poultry.
* Glycosinolates inhibit the absorption of iodine.
* Myrosinase enzymes, known as thioglucosidase enzymes, are consistently found alongside glucosinolates.
* Non-ruminants tolerate nitrate, but ruminants cannot.
* Pigs are most susceptible to nitrite poisoning.
* Monogastrics are highly toxic for gossypol.
* Pigs are more susceptible to gossypol poisoning than poultry.
* Ruminants and horses are resistant to gossypol toxicity.
* Gossypol causes olive green colour of the egg yolk.
* *Synergistes jonesii* rapidly degrades DHP of mimosine.
* Chronic hypersensitivity is frequently observed in feed antigens.
* Lectins, another ANF, can disrupt nutrient absorption in the gut of livestock.
* Phytates, present in many plant-based feeds, can bind to minerals, reducing their availability for absorption.
* Protease inhibitors hinder the activity of digestive enzymes, affecting protein digestion.
* Saponins, commonly found in legumes, can disrupt cell membranes and impact nutrient absorption.
* Oxalates, present in certain forages, can bind to calcium, forming insoluble crystals that may lead to mineral deficiencies.

**The frequently encountered anti-nutritional factors in feeds and fodders are:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Feedstuff** | **Anti-nutritional factor** | **Anti-nutritional factor category** | **Detoxification** |
| Neem Seed cake | Nimbin, Nimbidin, Azaradiractin, Tannins, Limonoids, Azadirone |  | By moist heat |
| Castor Seed meal | Ricin/Lectins | Proteins🡪Haemagglutinins | Steam treatment |
| Cassava leaves | HCN | Glycosides🡪Cyanogen | Sodium nitrite +Sodium Thiosulphate |
| Linseed | Linamarin, antipyridoxine (linatin) factor |  |  |
| Mahua Seed cake | Mowrin |  |  |
| Guar meal | Trypsin inhibitor, Antivitamin E Factor | Proteins🡪Protease inhibitor | Steam treatment or autoclaving |
| Karanj cake | Karanjine |  |  |
| Cotton Seed Cake | Gossypol | Phenols | Iron/ferrous sulphate |
| Raw soybean and its meal | Trypsin inhibitor, Phytohaemagglutinin, lipoxygenase, estrogen, saponin |  |  |
| Mustard or rapeseed | Glucosinolates, erucic acid |  |  |
| Salseed meal | Tannins | Phenols🡪polyphenolic | Detannification |
| Ambadi Cake | Nil | NIL | NIL |
| Tamarind seed hulls | Tannins | Phenols🡪polyphenolic | Detannification |
| Babul Seed powder | Tannins | Phenols🡪polyphenolic | Detannification |
| Babul Pods | Tannins | Phenols 🡪 polyphenolic | Detannification |
| Mango seed kernel | Tannins | Phenols🡪polyphenolic) | Detannification |
| Cowpea seed meal | Trypsin inhibitor | Proteins🡪Protease inhibitor | Steam treatment or autoclaving |
| Water hyacinth meal | Oxalic acid | Antimetals |  |
| Sugarcane bagasse | Lignin |  |  |
| Banana stems and leaves | Tannins | Phenols🡪polyphenolic | Detannification |
| Coconut pitch (coir waste) | Lignin |  |  |
| Rubber seed meal | HCN | Glycosides🡪Cyanogen | Sodium nitrite +Sodium Thiosulphate |
| Palm oil mill effluent | High ash (12-26%) |  |  |
| Spent tea leaves | Tannins | Phenols🡪polyphenolic | Detannification |

**Scientific names of some important by-product feeds from trees, grasses and field crops**

|  |  |
| --- | --- |
| **By- product** | **Scientific name** |
| Neem | *Azadiracta indica* |
| Mahua | *Madhuca indica* |
| Karanj | *Pongomia pinnatal* |
| Coconut | *Cocos nucifera* |
| Oil palm | *Elaeis quineensis* |
| Rapeseed cake | *Brassica campestris napus* |
| Clusterbean (Guar) | *Cyamopsis psoralioides* |
| Cassava | *Manihot esculenta* |
| Castor | *Ricnus communis* |
| Para grass(Buffalo or water grass) | *Brachiaria mutica* |
| Dinanath grass(Deenbandhu grass) | *Pennisetum pedicellatum* |
| Khejri tree(Sanjeevani of the desert) | *Psoropsis spicigera* |
| Water hyacinth | *Eichhornia cressipes* |

**Nutritive value and Optimum level of inclusion of NCFR in Ruminants ration**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of ingredient** | **DCP%** | **TDN%** | **Optimum inclusion level** |
| * 1. Ambadi cake | 18.7 | 64.0 | 20 |
| * 1. Guar meal | 23.0 | 65.0 | 10 |
| * 1. Karanj cake | 25.5 | 62.0 | 15 |
| * 1. Mahua cake | 8.0 | 60.0 | 20 |
| * 1. Rubber seed cake | 18.6 | 66.0 | 25-30 |
| * 1. Tapioca starch waste | 2.0 | 64.7 | 25 |
| * 1. Salseed meal | 1.6 | 57.8 | 10 |
| * 1. Tea waste | 9.7 | 43.0 | 20 |
| * 1. Poultry droppings | 25.0 | - | 15 |
| * 1. Poultry litter | 20.0 | - | 10 |
| * 1. Castor bean meal | 20.0 | 60.0 | 10 |
| * 1. Mangoseed kernel | 6.0 | 70.0 | 10 |
| * 1. Water hyacinth meal | 9.0 | 55.0 | 10-20 |

**Species most sensitive to different poisonings**

|  |  |
| --- | --- |
| Poultry | Saponin poisoning |
| Cattle | Cyanide poisoning |
| Rabbits | Gossyol poisoning |
| Pigs | Nitrite poisoning |

**QUESTIONS**

1. **A fat free product obtained by cooking of meat in water.**

|  |  |
| --- | --- |
| a) Tankage | b) Pressmud |
| c) Sludge | d) None |

1. **Duckweed is a valuable non-conventional feed resource because:**

|  |  |
| --- | --- |
| a) It is expensive | b) It is high in fiber |
| c) It is toxic to animals | d) It has a high protein content |

1. **Which anti-metabolite is commonly associated with inhibiting the metabolism of vitamin B12 in animals?**

|  |  |
| --- | --- |
| a) Oxalates | b) Mycotoxins |
| c) Ionophores | d) Tannins |

1. **A byproduct of sugar industry which can be utilized as mineral supplement for large ruminants.**

|  |  |
| --- | --- |
| a) Pressmud | b) Tankage |
| c) Molasses | d) Sugarcane trash |

1. **Black Soldier Fly larvae are rich in:**

|  |  |
| --- | --- |
| a) Carbohydrates | b) Antioxidants |
| c) Protein | d) Fiber |

1. **The main tubers include**

|  |  |
| --- | --- |
| a) Cassava | b) Sweet potato |
| c) Potato | d) All of these |

1. **By products of sugarcane industry that can be used in animal feeding are**

|  |  |
| --- | --- |
| a) Sugarcane bagasse | b) Molasses |
| c) Filter cakes | d) All of these |

1. **Mowrin is an anti-nutritional factor present in**

|  |  |
| --- | --- |
| a) Neem seed cake | b) Cottonseed cake |
| c) Mahua cake | d) Linseed cake |

1. **Tannins, found in certain plant materials, may:**

|  |  |
| --- | --- |
| a) Enhance protein synthesis | b) Inhibit protein digestion |
| c) Promote fat absorption | d) Increase energy metabolism |

1. **Which non-conventional feed resource is known for its high omega-3 fatty acid content?**

|  |  |
| --- | --- |
| a) Chia seeds | b) Barley |
| c) Sorghum | d) Alfalfa |

1. **What is the primary concern associated with the consumption of feeds contaminated with aflatoxins?**

|  |  |
| --- | --- |
| a) Cardiovascular diseases | b) Liver damage |
| c) Respiratory disorders | d) Bone fractures |

1. **Which of the following is an example of a leguminous non-conventional feed resource?**

|  |  |
| --- | --- |
| a) Millet | b) Lupin |
| c) Oats | d) Wheatgrass |

1. **Which non-conventional feed resource is known for its high cellulose content and is commonly used in ruminant diets?**

|  |  |
| --- | --- |
| a) Quinoa | b) Sunflower meal |
| c) Sawdust | d) Cactus pads |

1. **What is the primary concern associated with the presence of lectins in non-conventional feeds?**

|  |  |
| --- | --- |
| a) Gastrointestinal upset | b) Improved nutrient absorption |
| c) Enhanced immune response | d) Increased growth rates |

1. **Which non-conventional feed is rich in omega-6 fatty acids and is commonly used in poultry diets?**

|  |  |
| --- | --- |
| a) Lentils | b) Flaxseeds |
| c) Soybean meal | d) Black soldier fly larvae |

1. **The term "cyanogenic glycosides" is associated with which non-conventional feed resource?**

|  |  |
| --- | --- |
| a) Cassava | b) Amaranth |
| c) Buckwheat | d) Kale |

1. **Which animal species is most sensitive to for gossypol poisoning.**

|  |  |
| --- | --- |
| a) Pig | b) Poultry |
| c) Cattle | d) Horse |

1. **Anti-metabolites in animal nutrition:**

|  |  |
| --- | --- |
| a) Enhance nutrient absorption | b) Inhibit normal metabolic processes |
| c) Are only found in conventional feeds | d) Have no impact on animal health |

1. **Which non-conventional feed resource is rich in beta-glucans and is known for its immune-modulating properties?**

|  |  |
| --- | --- |
| a) Algae | b) Brewer's grains |
| c) Yeast | d) Chaffed hay |

1. **The term "gossypol" is associated with which non-conventional feed resource?**

|  |  |
| --- | --- |
| a) Sunflower meal | b) Cottonseed meal |
| c) Quinoa | d) Flaxseeds |

1. **Which non-conventional feed resource is known for its high content of essential amino acids, particularly lysine?**

|  |  |
| --- | --- |
| a) Duckweed | b) Bamboo shoots |
| c) Millet | d) Buckwheat |

1. **Palm kernel cake feeding causes ……………. toxicity.**

|  |  |
| --- | --- |
| a) Copper | b) Molybdenum |
| c) Cobalt | d) Manganese |

1. **Which non-conventional feed resource is known for its ability to fix atmospheric nitrogen and improve soil fertility?**

|  |  |
| --- | --- |
| a) Jatropha meal | b) Chia seeds |
| c) Velvet bean | d) Rapeseed meal |

1. **The term "saponins" is associated with which characteristic of some non-conventional feeds?**

|  |  |
| --- | --- |
| a) Bitter taste | b) Aroma |
| c) High protein content | d) Low fiber content |

1. **Which non-conventional feed resource is known for its drought-resistant characteristics and is suitable for arid regions?**

|  |  |
| --- | --- |
| a) Duckweed | b) Alfalfa |
| c) Quinoa | d) Cassava |

1. **The term "phytosterols" is associated with which potential benefit of certain non-conventional feeds?**

|  |  |
| --- | --- |
| a) Enhanced fiber digestion | b) Improved lipid metabolism |
| c) Increased methane production | d) Reduced protein content |

1. **The anti-metabolites present in raw soybean are:**

|  |  |
| --- | --- |
| a)Trypsin inhibitor | b) Phytohaemaggutinin |
| c)Estrogen | d ) All of these |

1. **Antivitamin E factor is present in:**

|  |  |
| --- | --- |
| a) Coconut meal | b) Guar meal |
| c) Linseed | d) Groundnut |

1. **Mowrin is an antimetabolite present in:**

|  |  |
| --- | --- |
| a) Castor seed | b) Mahua cake |
| c) Neem cake | d) Sunflower seed |

1. **Which animal is more resistant to tannins:**

|  |  |
| --- | --- |
| a) Sheep | b) Buffalo |
| c) Cattle | d) Goat |

1. **Fungal species used in biological treatment of sugarcane bagasse**

|  |  |
| --- | --- |
| a) Pleorotus | b) Caprinus |
| c) Both | d) None |

1. **Safe limit of tannins in ruminant ration**

|  |  |
| --- | --- |
| a) 2-4% | b) 4-6% |
| c) 8-10% | d) 10-15% |

1. **Toxic principle present in paddy straw is**

|  |  |
| --- | --- |
| a) Oxalates | b) Saponins |
| c) HCN | d) Linamarin |

1. **Anti-nutritional factor present in linseed cake is**

|  |  |
| --- | --- |
| a) Gossypol | b) Nitrate |
| c) HCN | d) Linamarin |

1. **Biological treatment of sugarcane bagasse can be done by use of following fungus**

|  |  |
| --- | --- |
| a) Caprinus | b) Caprinus |
| c) Both | d) None |

1. **How can the negative effects of mycotoxin contamination be minimized in animal diets?**

|  |  |
| --- | --- |
| a) Regular mold inspections | b) Increasing mycotoxin levels for adaptation |
| c) Storing feed in humid conditions | d) Avoiding additives altogether |

1. **The term "phytocannabinoids" is associated with which potential characteristic of certain non-conventional feeds?**

|  |  |
| --- | --- |
| a) Hindered lipid metabolism | b) Improved amino acid absorption |
| c) Increased energy levels | d) Enhanced antioxidant properties |

1. **The term "sorghum bicolor" is associated with which non-conventional feed resource?**

|  |  |
| --- | --- |
| a) Black soldier fly larvae | b) Sorghum |
| c) Chia seeds | d) Jatropha meal |

1. **Which non-conventional feed resource is known for its potential role in reducing ammonia emissions from livestock operations?**

|  |  |
| --- | --- |
| a) Duckweed | b) Millet |
| c) Spirulina | d) Velvet bean |

1. **The term "ferulic acid" is associated with which potential benefit of certain non-conventional feeds?**

|  |  |
| --- | --- |
| a) Improved amino acid absorption | b) Hindered lipid metabolism |
| c) Antioxidant properties | d) Enhanced protein digestion |

1. **The term "zein" is associated with which potential characteristic of certain non-conventional feeds?**

|  |  |
| --- | --- |
| a) Hindered lipid metabolism | b) Improved amino acid absorption |
| c) Increased energy levels | d) Enhanced protein digestion |

1. **The term "xanthophylls" is associated with which potential characteristic of certain non-conventional feeds?**

|  |  |
| --- | --- |
| a) Improved protein absorption | b) Enhanced energy levels |
| c) Pigment content for poultry skin and egg yolk color | d) Hindered lipid metabolism |

1. **Which anti-nutritional factor is commonly associated with inhibiting protein digestion by binding with minerals in non-conventional feeds?**

|  |  |
| --- | --- |
| a) Tannins | b) Mycotoxins |
| c) Phytates | d) Lectins |

1. **The term "sulforaphane" is associated with which potential benefit of certain non-conventional feeds?**

|  |  |
| --- | --- |
| a) Antioxidant properties | b) Hormone-like compounds |
| c) Improved amino acid absorption | d) Hindered lipid metabolism |

1. **Which non-conventional feed resource is known for its potential prebiotic effects in promoting gut health in animals?**

|  |  |
| --- | --- |
| a) Seaweed | b) Insects |
| c) Chicory | d) Barley |

1. **Which non-conventional feed resource is known for its high phosphorus content and is often used to balance diets in monogastric animals?**

|  |  |
| --- | --- |
| a) Soybean meal | b) Bone meal |
| c) Chia seeds | d) Camelina meal |

1. **Fish meal is found to contain**

|  |  |
| --- | --- |
| a) Gizzarosine | b) Oxalate |
| c) Nitrate | d) None |

1. **Tannin is present in:**

|  |  |
| --- | --- |
| a)Soybean | b)Salseed |
| c)Sorghum | d)Both b and c |

1. **Sweet clover disease is caused due to**

|  |  |
| --- | --- |
| a)Coumerin | b)Mimosine |
| c)Lathyrogen | d)Genistin |

1. **Common adulterant present in fishmeal is**

|  |  |
| --- | --- |
| a) Sand | b) Common salt |
| c) Urea | d) All the above |

1. **Which of the following specie cannot utilize phytate present in feed?**

|  |  |
| --- | --- |
| a)Poultry | b) Sheep |
| c) Goat | d)Buffalo |

1. **Common adulterant in broken rice is**

|  |  |
| --- | --- |
| a) Sand | b) Common salt |
| c) Urea | d) Marble grit |

1. **Anti- nutritional factor present in Jatropha curcus is**

|  |  |
| --- | --- |
| a) Nitrate | b) Phorbol esters |
| c) Mowrin | d) HCN |

1. **Anti- nutritional factor present in Water Hyacinth is**

|  |  |
| --- | --- |
| a) HCN | b) Phytate |
| c) Nimbin | d) Oxalic acid |

1. **Optimum level of inclusion of poultry droppings (%) in concentrate mixture is**

|  |  |
| --- | --- |
| a) 25 | b) 20 |
| c) 15 | d) 30 |

1. **Optimum level of inclusion of poultry litter(%) in concentrate mixture is**

|  |  |
| --- | --- |
| a) 15 | b) 25 |
| c) 10 | d) 30s |

1. **Optimum level of inclusion of guar meal(%) in concentrate mixture is**

|  |  |
| --- | --- |
| a) 15 | b) 25 |
| c) 10 | d) 30 |

1. **Optimum level of inclusion of Karanj cake(%) in concentrate mixture is**

|  |  |
| --- | --- |
| a) 10 | b) 25 |
| c) 15 | d) 30 |

1. **Optimum level of inclusion of Mahua cake(%) in concentrate mixture is**

|  |  |
| --- | --- |
| a) 5 | b) 10 |
| c) 15 | d) 20 |

1. **DCP (on % DMB) of poultry droppings is**

|  |  |
| --- | --- |
| a) 10 | b) 15 |
| c) 20 | d) 25 |

1. **DCP (on % DMB) of poultry litter is**

|  |  |
| --- | --- |
| a) 10 | b) 15 |
| c) 20 | d) 25 |

1. **DCP (on % DMB) of Mahua cake is**

|  |  |
| --- | --- |
| a) 10 | b) 8.0 |
| c) 5.0 | d) 12 |

1. **DCP (on % DMB) of Karanj cake is**

|  |  |
| --- | --- |
| a) 10 | b) 15 |
| c) 20 | d) 25 |

1. **DCP (on % DMB) of Guar meal is**

|  |  |
| --- | --- |
| a) 15 | b) 23 |
| c) 19 | d) 20 |

1. **DCP (on % DMB) of castor bean meal is**

|  |  |
| --- | --- |
| a) 5 | b) 10 |
| c) 15 | d) 20 |

1. **DCP (on % DMB) of castor mangoseed kernel is**

|  |  |
| --- | --- |
| a) 3 | b) 6 |
| c) 9 | d) 12 |

1. **Castor seed meal contains toxin**

|  |  |
| --- | --- |
| a) Oxalic acid | b) Theobromine |
| c) HCN | d) Ricin |

1. **Toxic factors present in neem seed and its meal**

|  |  |
| --- | --- |
| a) Nimbin | b) Azadirone |
| c) Azadiractin | d) All the above |

1. **Crude protein (% ) content of feather meal is**

|  |  |
| --- | --- |
| a) 80 | b) 30 |
| c) 55 | d) 47 |

1. **Pink discolourations of egg albumin is due to**

|  |  |
| --- | --- |
| a) Cyclopropenoid fatty acids | b) Malvalic acid |
| c) Sterculic acid | d) All of the above |

1. **Which animal species is most susceptible to cyanogenic toxicity:**

|  |  |
| --- | --- |
| a) Cow | b) Dog |
| c) Horse | d) Pig |

1. **Lipoxygenase in soybean seeds has …………… activity**

|  |  |
| --- | --- |
| a) Antivitamin A | b) Antivitamin B |
| c) Antivitamin C | d) Antivitamin D |

1. **Protease inhibitors present in soybean are:**

|  |  |
| --- | --- |
| a) Kunitz | b) Bowman Birk |
| c) Both | d) None of these |

1. **Bowman-birk inhibitor present in soybean meal binds with**

|  |  |
| --- | --- |
| a) Trypsin | b) Chymotrypsin |
| c) Pepsin | d) Both a and b |

1. **Kunitz factor present in soybean meal binds with**

|  |  |
| --- | --- |
| a) Trypsin | b) Chymotrypsin |
| c) Pepsin | d) Both a and b |

1. **Which animal species is most sensitive to for nitrite poisoning.**

|  |  |
| --- | --- |
| a) Pig | b) Poultry |
| c) Cattle | d) Horse |

1. **Musty odour of feed is due to**

|  |  |
| --- | --- |
| a) Fungal contamination | b) Bacterial |
| c) Viral | d) None |

1. **Aflatoxins are usually found most frequently in**

|  |  |
| --- | --- |
| a) Groundnut cake | b) Cotton seed cake |
| c) Maize | d) Oat |

1. **Antinutrients present in rapeseed meal**

|  |  |
| --- | --- |
| a) Glucosinolates | b) Tannins |
| c) Erucic acid | d) All of these |

1. **Which animal species is resistant to gossypol poisoning**

|  |  |
| --- | --- |
| a) Horse | b) Cattle |
| c) Swine | d) Poultry |

1. **Acute aflatoxicosis is common in**

|  |  |
| --- | --- |
| a) Poultry | b) Pig |
| c) Sheep | d) Cattle |

1. **One challenge related to the use of unconventional feeds is:**

|  |  |
| --- | --- |
| a) Wide availability in all regions | b) Consistent accessibility for all farmers |
| c) Limited availability in certain regions | d) Uniform pricing worldwide |

1. **What is a primary advantage of using insect-based feeds?**

|  |  |
| --- | --- |
| a) Low protein content | b) Limited availability |
| c) High feed conversion rates | d) High water content |

1. **What nutrient is often abundant in algae, making it a valuable feed supplement?**

|  |  |
| --- | --- |
| a) Carbohydrates | b) Vitamin C |
| c) Omega-3 fatty acids | d) Iron |

1. **What is a key characteristic of single-cell proteins (SCP) used in animal feeds?**

|  |  |
| --- | --- |
| a) Low protein content | b) Derived from multicellular organisms |
| c) High digestibility | d) High water content |

1. **Which of the following is considered an alternative protein source for animal feed?**

|  |  |
| --- | --- |
| a) Soybean meal | b) Fish meal |
| c) Insect | d) Corn silage |

1. **Which of the following is rich in tannins**

|  |  |
| --- | --- |
| a) Babul pods | b) Soybean meal |
| c) Mahua cake | d) Salseed cake |

1. **Tannins can bind with**

|  |  |
| --- | --- |
| a) PEG | b) PVPP |
| c) Both | d) None |

1. **Which animal species are more resistant to tannins**

|  |  |
| --- | --- |
| a) Cattle | b) Buffalo |
| c) Sheep | d) Goat |

1. **Which animal species is most sensitive to for saponin poisoning.**

|  |  |
| --- | --- |
| a) Pig | b) Poultry |
| c) Cattle | d) Horse |

1. **Which animal species is most sensitive to for HCN poisoning.**

|  |  |
| --- | --- |
| a) Pig | b) Poultry |
| c) Cattle | d) Horse |

1. **Anti nutritional factor present in paddy straw is**

|  |  |
| --- | --- |
| a) Oxalates | b) HCN |
| c) Tannin | d) Nitrate |

1. **The different characteristics of NCFR include:**
2. They are mainly organic and can be in a solid, slurry or liquid form
3. Their economic value is often less
4. Majority are bulky and of poor quality cellulosic material
5. All the statements are correct
6. **Identify the correct option:**
7. Soybean-Trypsin inhibitor, Guar meal- Antivitamin E, Mahua cake- Mowrin, Mustard cake- Goiterogen
8. Soybean-Goiterogen, Guar meal- Antivitamin E, Mahua cake- Mowrin, Mustard cake- Trypsin inhibitor
9. Soybean- Antivitamin E, Guar meal- Goiterogen, Mahua cake- Trypsin inhibitor, Mustard cake-Mowrin
10. Soybean-Trypsin inhibitor, Guar meal- Goiterogen, Mahua cake- Mowrin, Mustard cake- Antivitamin E
11. **Identify the correct statement:**
12. Para grass-Buffalo grass, Dinanath grass- Deenbandhu grass, Napier grass- Elephant grass, Hariali grass- Doob grass
13. Para grass-Buffalo grass, Dinanath grass- Elephant grass, Napier grass- Deenbandhu grass, Hariali grass- Doob grass
14. Para grass- Elephant grass, Dinanath grass- Deenbandhu grass, Napier grass- Buffalo grass, Hariali grass- Doob grass
15. Para grass- Doob grass, Dinanath grass- Deenbandhu grass, Napier grass- Elephant grass, Hariali grass- Buffalo grass
16. **Identify the correct statement:**
17. Saponins are degraded by rumen microbes.
18. Excess feeding of saponins leads to bloat.
19. Pigs are more sensitive to saponin poisoning than pigs.
20. Average saponin content of stem is twice as much as those of the leaves.
21. Statement I,II, III are correct.
22. Statement I, II are correct.
23. Statement I, II, IV are correct.
24. All the statements are correct.
25. **Identify the correct statement:**
26. Hydrolyzable tannins are more toxic to animals.
27. Condensed tannins are more toxic to animals.
28. Both hydrolyzable tannins and condensed tannins are toxic to animals.
29. Tannins are not toxic to animals.

1. **Identify the correct statement:**
2. Thiaminase, Amprolium and Pyrrithiamine are antimetabolites of B1.
3. Dicoumoral, Sulphoquinoxaline are antagonists of Vitamin K.
4. Oral contaceptives and anti tuberculosis drugs are antagonists to Vitamin B6.
5. All the statements are correct.
6. **Identify the statement which correctly describes potential advantages of waste based feeds for livestock.**
7. Recycling food waste into livestock feed is environmentally sustainable.
8. Waste-based feeds have no nutritional value for livestock.
9. Waste-based feeds can contribute to reducing the environmental impact of livestock feeds.
10. Fermentation has no role in the production of waste-based feeds.
11. Statement I and III are correct.
12. Statement I,III and IV are correct.
13. Statement I and II are correct.
14. All the statements are correct.
15. **Which statement(s) is/are true about unconventional protein sources for livestock?**

I. Insect frass, the excrement of insects, is explored as a potential protein source.

II. Soybean meal is considered the sole protein source for modern livestock nutrition.

III. Black Soldier Fly larvae are rich in protein and fat.

IV. Grasshoppers and crickets are low in protein and not suitable for livestock.

a. Statement I and III are correct.

b. Statement I,III and IV are correct.

c. Statement I and II are correct.

d. All the statements are correct.

1. **Identify the correct statement regarding secondary plant compounds:**

I. SPCs are antiherbivory chemicals.

II. Tannins are included under SPCs

III. SPCs are so named because few have primary metabolic functions within the plant and at one time they were viewed as end products of other metabolic systems.

IV. Phenolics, terpenoids and alkaloids are the prevalent groups included under SPCs.

a. Statement I and III are correct.

b. Statement I,III and IV are correct.

c. Statement I and II are correct.

d. All the statements are correct.

1. **Identify the correct statement:**

I. About 67% or more of the phosphorus in cereal grains is in the form of phytin phosphorus.

II. Phytic acid depress the utilization of several mineral elements such as Ca, Mg, Fe, Zn, etc.

III. Phytic acid is an ether formed by combination of 6 alcoholic groups of inositol with 6 molecules of hexaphosphoric acid.

IV. Seeds of cereals, dried legumes, oilseeds and nuts are rich in phytic acid.

a. Statement I,II, III are correct.

b. Statement I,III and IV are correct.

c. Statement I, II, IV are correct.

d. All the statements are correct.

1. **Identify the correct statement:**

I. Raw soybean contains Anti vitamin A which can be destroyed by heating 5 min with steam at atmospheric pressure.

II. Antivitamin E present in raw soybean can be destroyed by autoclaving.

III. HCN present in castor meal is destoyed by steam treatment.

IV. Nimbin presnt in neem seed cake can be destroyed by moist heat.

V.Gossypol present in cottonseed cake can form complex with ferrous sulphate.

a. Statements I, II, III are correct.

b. Statements I,II,IV are correct.

c. Statements I,IV,V are correct.

d. All the statements are correct.

1. **Identify the correct statement:**

I. Oxalates are toxicologically antagonistic to minerals like Ca,Mg, Na.

II. Oxalate poisoning is characterized by hypocalcemia, uremia, etc.

III. Oxalic acid is an organic acid occurring in a range of plant species commonly consumed by the ruminants.

IV.Most oxalate containing plants are palatable to livestock.

V. Force feeding of water is the only treatment if the animal is intoxicated with oxalate poisoning.

a. Statements I, II, III are correct.

b. Statements II, III,IV are correct.

c. Statements II, III,IV,V are correct.

d. All the statements are correct.

1. **Identify the correct statements:**

I. Tannins increase the palatability of forage due to astringency.

II. Hydrolysable tannins are potentially toxic to animals

III. Condensed tannins bind to proteins and protect them from excessive degradation in the rumen.

IV. Hydrolysable tannins are the most abundant type of tannins

V. Tannins are polyphenolic compounds with low molecular weight.

a. Statements I, II, III, IV, V are correct.

b. Statements I, IV, V are correct.

c. Statements II, III are correct.

d. All the statements are correct.

1. **Identify the correct statement:**

I. Higher lignin content indicates maturation of plant.

II. Higher lignin content reduces the digestibility of feed.

III. Higher lignin content increases the digestibility of feed.

IV. Lignin acts as internal indicator.

1. Wood products, mature hays and straw are rich in lignin.

a. Statement I,II,IV,V are correct.

b. Statement I,III,IV,V are correct.

c. Statement I,II,IV are correct.

d. All the statements are correct.

1. **Identify the correct statement:**

I. Poultry are more sensitive than pigs for saponin poisoning.

II.Ruminants are more susceptible than horses and pigs for HCN poisoning.

III.Cattle are most susceptible than sheep for HCN poisoning.

IV.Pigs and rabbits are more sensitive than poultry for gossypol poisoning.

V.Pigs are most susceptible to nitrite poisoning as compared to cattle, sheep and horses.

a. Statement I,II,III are correct.

b. Statement I,III,IV,V are correct.

c. Statement I,II,IV,V are correct.

d. All the statements are correct.

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Saponin poisoning | 1. Rabbits |
| 1. Cyanide poisoning | 1. Pigs |
| 1. Gossyol poisoning | 1. Poultry |
| 1. Nitrite poisoning | 1. Cattle |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Cotton seed | 1. Tannins |
| 1. Soybean | 1. Erucic acid |
| 1. Groundnut | 1. Lipoxygenase |
| 1. Rapeseed | 1. Cyclopropenoid fatty acid |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Mahua cake | 1. Quinic acid |
| 1. Castor seed | 1. Mowrin |
| 1. Kapok seed meal | 1. Tannins |
| 1. Sunflower seed | 1. Ricin |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Oats | 1. HCN |
| 1. Tapioca meal | 1. Estrogens |
| 1. Guar meal | 1. Linatine |
| 1. Linseed | 1. Antivitamin E |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Tannins | 1. Arabinoxylans |
| 1. Barley | 1. Oxalates |
| 1. Wheat | 1. Beta glucans |
| 1. Molasses | 1. Top feeds |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. GNC | 1. Amygdalin |
| 1. Soybean | 1. Dhurrin |
| 1. Sorghum | 1. Bowman birk |
| 1. Bitter almond | 1. Aflatoxin |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Cottonseed cake | 1. Linamarin |
| 1. Subabool | 1. Amygdalin |
| 1. Linseed cake | 1. mimosine |
| 1. Almond | 1. gossypol |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Jowar | 1. HCN |
| 1. Fishmeal | 1. Dhurrin |
| 1. Soybean seeds | 1. Gizzarosine |
| 1. Cassava leaves | 1. Lipoxygenase |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Neem | 1. Madhuca indica |
| 1. Mahua | 1. Brassica campestris napus |
| 1. Rapeseed cake | 1. Glycine max |
| 1. Soybean | 1. Azadiracta indica |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Copra meal | 1. Karanjine |
| 1. Tapioca meal | 1. Estrogenic factor |
| 1. Karanj cake | 1. Lipoxygenase |
| 1. Peas | 1. HCN |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Trypsin inhibitor | 1. FeSO4 |
| 1. Cyanide posioning | 1. Methylene blue |
| 1. Nitrate poisoning | 1. Sodium nitrite and sodium thiosulphate |
| 1. Gossypol poisoning | 1. Autoclaving |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Maize | 1. Fleming gold |
| 1. Oats | 1. Sirsa-9 |
| 1. Cowpea | 1. African tall variety |
| 1. Lucerne | 1. Russian giant |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Ruminants | 1. Saponins |
| 1. Poultry | 1. Aflatoxin |
| 1. Pigs | 1. HCN |
| 1. Duck | 1. Gossypol |

1. **Match:**

|  |  |
| --- | --- |
| **A** | **B** |
| 1. Anti vitamin E | 1. Sweet clover |
| 1. Anti vitamin K | 1. Linseed meal |
| 1. Anti vitamin B6 | 1. Kidney bean |
| 1. Anti vitamin D | 1. Soybean seed |

**Fill in the blanks:**

1. Methane production ………………… by feeding of tannins to animals.
2. Anti nutritional factor present in raw fish is ……………….. .
3. Anti- nutrient present in paddy straw is ………………….. .
4. Pusa giant is a variety of ………………… fodder.
5. Anti nutritional factor present in oats is ……………… .
6. Nitrate poisoning is also known as ……………………………. .
7. Linatine present in linseed is antagonistic to …………….... vitamin.
8. Anti nutritional factor present in Bajra is ……………….. .
9. Anti nutritional factor present in neem is ……………………. .
10. Whole cottonseed contains a total of ………………. % gossypol.
11. Whole cottonseed contains ….………………. % free gossypol. 0.19
12. Metabolites of glucoinolates include ……………, ………….., ……………………. , etc.
13. Anti nutritional factor present in molasses is ……………………. .
14. Goiterogenic complex formed by cyclization between isothiocynates and myrosinase enzyme is ……………………...... .
15. During the process of ensiling, mimosine is converted to ……………………….. .
16. ……………….. tannins are the most abundant type of tannins present in leguminous seeds and forages.
17. *Leucaena leucocephala* contains ……………….. anti- metabolite.
18. ……………….. is an antimetabolite present in raw egg.
19. Anti nutritional factor present in rapeseed is ……………………… .
20. Lupinosis is characterized by ………………. and is caused by fungus …………………. .
21. Anti nutritional factor present in cottonseed cake is ……………………… .
22. Safe limits of tannins in ruminant rations are ……………. .
23. Bloat occurs due to excessive ingestion of ………………….. anti nutritional factor.
24. Anti nutritional factor present in castor bean is …………………….
25. Subabool contains ………………………. Anti nutritional factor which affect the utilization of ………………… in animal body.
26. Anti nutritional factor present in Jowar is ……………………… .
27. Palm kernel cake feeding causes ……………. toxicity.
28. …………………. are a toxic heterocyclic hydrocarbon created by the manufacture of chlorine and such chlorinated compounds.
29. Anti nutritional factor present in soybean is …………………………... .
30. Mustard cake is commonly adulterated with ………………………….. .
31. Anti nutritional factor present in groundnut cake is ……………………..
32. Anti nutritional factor present in cassava is ……………………. .
33. Mescawi is a variety of ……………………. .
34. Anti nutritional factor present in Bitter almond is ……………………….. .
35. Anti nutritional factor present in wheat is ………………………… .
36. About ……....... percent of phosphorus in cereal grains is present as phytin phosphorus.
37. Anti nutritional factor present in barley is …………………… .
38. Goiterogen produced from mimosine by rumen bacteria is ……………… .
39. Heat labile toxic factor present in soybean is ……………… .
40. Tannins are synthesized by ……………….. pathway.

**ANSWER KEY**

1. (a) Tankage
2. d) It has a high protein content
3. a) Oxalates
4. a) Pressmud
5. c) Protein
6. d) All of these
7. d) All of these
8. c) Mahua cake
9. b) Inhibit protein digestion
10. a) Chia seeds
11. b) Liver damage
12. b) Lupin
13. c) Sawdust
14. a) Gastrointestinal upset
15. c) Soybean meal
16. a) Cassava
17. a) Pig
18. b) Inhibit normal metabolic processes
19. c) Yeast
20. b) Cottonseed meal
21. a) Duckweed
22. a) Copper
23. c) Velvet bean
24. a) Bitter taste
25. d) Cassava
26. b) Improved lipid metabolism
27. d) All of these
28. b) Guar meal
29. b) Mahua cake
30. d) Goat
31. c) Both
32. a) 2-4%
33. a) Oxalates
34. d) Linamarin
35. c) Both
36. a) Regular mold inspections
37. a) Hindered lipid metabolism
38. b) Sorghum
39. a) Duckweed
40. c) Antioxidant properties
41. d) Enhanced protein digestion
42. c) Pigment content for poultry skin and egg yolk color
43. c) Phytates
44. a) Antioxidant properties
45. c) Chicory
46. b) Bone meal
47. a) Gizzarosine
48. d) Both b and c
49. a) Coumerin
50. d) All the above
51. a) Poultry
52. d) Marble grit
53. b) Phorbol esters
54. d) Oxalic acid
55. c) 15
56. c) 10
57. c) 10
58. c) 15
59. d) 20
60. d) 25
61. c) 20
62. b) 8.0
63. d) 25
64. b) 23
65. d) 20
66. b) 6
67. d) Ricin
68. d) All the above
69. a) 80
70. d) All of the above
71. a) Cow
72. a) Antivitamin A
73. c) Both
74. d) Both a and b
75. a) Trypsin
76. a) Pig
77. a) Fungal contamination
78. a) Groundnut cake
79. d) All of these
80. a) Horse
81. b) Pig
82. c) Limited availability in certain regions
83. c) High feed conversion rates
84. c) Omega-3 fatty acids
85. c) High digestibility
86. c) Insect
87. a) Babul pods
88. c) Both
89. d) Goat
90. b) Poultry
91. c) Cattle
92. a) Oxalates
93. d) All the statements are correct
94. a) Soybean-Trypsin inhibitor, Guar meal- Antivitamin E, Mahua cake- Mowrin, Mustard cake- Goiterogen
95. a) Para grass-Buffalo grass, Dinanath grass- Deenbandhu grass, Napier grass- Elephant grass, Hariali grass- Doob grass
96. b) Statement I, II are correct.
97. a) Hydrolyzable tannins are more toxic to animals.
98. d) All the statements are correct.
99. a) Statement I and III are correct.
100. a) Statement I and III are correct.
101. d) All the statements are correct.
102. c) Statement I, II, IV are correct.
103. c) Statements I,IV,V are correct.
104. c) Statements II, III,IV,V are correct.
105. c) Statements II, III are correct.
106. a) Statement I,II,IV,V are correct.
107. d) All the statements are correct.
108. c) poultry, d) cattle, a) rabbits, b) pigs
109. d Cyclopropenoid fatty acid, c.Lipoxygenase, a.Tannins, b.Erucic acid
110. b.Mowrin, d.Ricin, c.Tannins, a.Quinic acid
111. b.Estrogens, a.HCN, d.Antivitamin E, c.Linatine
112. d.Top feeds, c.Beta glucans, a.Arabinoxylans, b.Oxalates
113. d.Aflatoxin, c.Bowman birk, b.Dhurrin, a.Amygdalin
114. d.gossypol, c.mimosine, a.Linamarin, b.Amygdalin
115. b.Dhurrin, c.Gizzarosine, d.Lipoxygenase, a.HCN
116. d.Azadiracta indica, a.Madhuca indica, b.Brassica campestris napus, c.Glycine max
117. Estrogenic factor, HCN, Karanjine, Lipoxygenase
118. d.Autoclaving, c.Sodium nitrite and sodium thiosulphate, b.Methylene blue, a.FeSO4
119. c.African tall variety, a.Fleming gold, d.Russian giant, b.Sirsa-9
120. c.HCN, a.Saponins, d.Gossypol, b.Aflatoxin
121. c.Kidney bean, a.Sweet clover, b.Linseed meal, d.Soybean seed
122. Decreases
123. Thiaminase
124. Oxalates
125. Berseem
126. Nitrate
127. Oat hay poisoning
128. Pyridoxine
129. Oxalate
130. Nimbin
131. 1.09-1.53
132. 0.19
133. Thiocynates, Isothiocyanates, Nitriles
134. Oxalate
135. Vinyloxazolidinethione
136. DHP
137. Condensed tannins
138. Mimosine
139. Avidin
140. Glucosinolate
141. Severe liver damage, *Phomopsis leptostromiformis*
142. Gossypol
143. 2-4%
144. Saponin
145. Ricin
146. Mimosine, Iodine
147. Dhurrin
148. Copper
149. Dioxins
150. Trypsin inhibitor
151. Argimona Mexicana seeds
152. Aflatoxin
153. Linamarin
154. Berseem
155. Amygdalin
156. Arabinoxylans
157. 67%
158. Beta glucans
159. DHP
160. Lectin
161. Shikimic acid pathway