Indian Farmer

ISSN 2394-1227

A Monthly Magazine

Volume: 3 | Issue-3 | March- 2016 | Pages - 60

Horticulture

Tongue Grafting in Sohiong

www.indianfarmer.net

INDIAN FARMER

A Monthly Magazine

Volume: 3, Issue-3 **March -2016**

Strategies to Economic Analysis In Broiler Farming

Kuldeep Kumar Panigrahy*, Sasmita Panda, Dayanidhi Behera, Kumaresh Behera and Siddhant Sekhar Sahoo[1]

Department of Livestock Production and Management, OUAT
[1]M.V.Sc, Department of Animal Genetics and Breeding, OUAT
Corresponding Author: kul.pani42@gmail.com

Abstract

The growth of the poultry sector is mainly attributed to the interventions of the corporate sector with an enabling policy environment provided by the Government of India / State Governments from time to time. The activity provides huge employment opportunities for the rural poor either under Backyard poultry production system or under small scale commercial broiler farming unit (Prasad et al.)s. Over 5 million people are engaged in the poultry sector either directly or indirectly (Steinfeld et al.). Owing to the considerable growth in broiler industry, high quality chicks, equipment, vaccines and medicines, technically and professionally competent guidance are available to the farmers. The management practices have improved and disease and mortality incidences are reduced to a great extent. Many institutions are providing training to entrepreneurs. Increasing assistance from the Central/ State governments and poultry corporations is being given to create infrastructure facilities so that new entrepreneurs are attracted to take up this business (Thurstone et al.)s. Broiler farming has been given considerable importance in the national policy and has a good scope for further development in the years to come.

1. Introduction

Poultry meat is an important source of high quality proteins, minerals and vitamins to balance thehuman diet. Specially developed varieties of chicken (broilers) are now available with the traits of quick growth and high feed conversion efficiency. Depending on the farm size, broiler farming can be a main source of family income or can provide subsidiary income and gainful employment to farmers throughout the year. Poultry manure is of high fertilizer value which can be used for increasing yield of all crops.

The advantages of broiler farming are

a) Initial investment is lower than layer farming
b) Rearing period is 5-6 weeks only
c) More number of flocks can be taken in the same shed
d) Broilers have high feed conversion efficiency i.e. the amount of feed required for unit body weight gain is lower in comparison to other livestock
e) Faster return from the investment

2. Scope for broiler farming and its national importance

India has made tremendous progress in broiler production during the last three decades and the broilerpopulation in the country during 2011-12 stood at 2300 million. Today India is the fifth largest producer of broiler meat in the world with an annual production of 2.47 million MT. Despite this achievement, the per capita availability of poultry meat in India is only 2.96 kg which is way below the ICMR recommendation of 11 kg meat per capita per annum.

3. Integration in Broiler Farming

There is a growing trend of integration in broiler farming. In the early nineties, contract farming forbroilers was introduced and in 1995 it spread all over Tamil Nadu. Between 1995 and 2000, it spread to Karnataka (Behnke et al.). It gathered momentum and spread its wings to Maharashtra, Andhra Pradesh in theyears 2001 & 2002 and after that, it gained inroads into West Bengal and Gujarat. The spread is due to in built strengths in integration system. Integrators takes care of all aspects of production, right from raising of grandparent and parent flocks, production of day old chicks for rearing, manufacturing and supply of concentrate feed, providing veterinary services and wholesale marketing of birds. Under integration all the previous profit centers of the broiler industry viz. chick selling, feed selling, hatching, medicine supply, transportation have become cost centers for the integrators who work as a single entity and distribute the benefits among the farmer, consumer and the integration company themselves. Under contract farming, poultry farmers invest only for poultry sheds / equipment on their existing land(Bojo et al.). The Integrator supplies chicks, feed, and medicines, provides technical guidanceand also buy back / purchase the entire production after 5-6 weeks(Sidahmed et al.). The contract farmers are paidrearing charges usually on per kg Live Weight basis and also as per the set of criteria prescribed bythe integrators viz., FCR, Mortality etc. Farmer is benefiting from the lesser investment andproduction cost and also higher productivity which are achieved as a result of integration. Moreoverhe/she is insulated from the market price fluctuations. However, the farmer may be at a disadvantage if the number of batches supplied in the year by the integrator is less.

4. Financial assistance available from Banks for broiler farming

For poultry farming schemes with large outlays Detailed Project Reports (DPR) are required to be prepared. The items of investment / finance would include construction of broiler sheds and purchase of equipment, cost of day old chicks, feed, medicine and labour cost for the first cycle(Prasad et al.). Cost towardsland development, fencing, water and electricity, essential servant's quarters, godowns, transportvehicles, broiler dressing, processing and cold storage facilities can also be considered for providingcredit. For high value projects, the borrowers can utilise the services of NABARD Consultancy Services (NABCONS) who are having wide experience in preparation of Detailed Project Reports.

5. Economics of Poultry Broiler Farming

A model economics for broiler farming with a unit size of 10000 birds is given below. This is indicative and the applicable input and output costs and the parameters observed at the field level may be incorporated.

Capital Cost	
Construction of shed (10000 SQ. FT @ Rs.150/sft) including electrification	1575000
Feed room - 1000 sft @ Rs.200/sft	200000
Cost of equipment	262500
Total	**2037500**
Recurring Expenditure	
Cost of day old chicks	231000
Cost of feed	673200
Medicines, labour, miscellaneous charges	102000
Insurance of birds	31500
Insurance of sheds and equipment	20375
Total	**1058075**
Grand Total (A+B)	3095575
Say	3177000
Margin (25%)	476550
Bank Loan	2700450

B. Techno Economic Parameters

Number of birds	10000
Batch strength	10000
Birds purchased per batch	10500
Birds considered for recurring expenditure	10200
Birds considered for selling	10000
Floor space per bird (s.ft)	1
Construction cost of shed (Rs. per sft)	150
Cost of equipment (Rs. per bird)	25
Cost of day old chick (Rs. per bird)	22
Feed requirement per bird (Kg)	3.3
Cost of feed (average price Rs. per kg)	20
Medicines, vaccines, labour and misc.	10
Insurance per bird (Rs. per bird)	0.5
Insurance of sheds and equipment (Rs. per Rs.1,000/-)	10
Live weight of bird (Kg per bird)	1.7
Sale price (Rs. per kg)	70
Value of manure per bird sold (Rs. per bird)	0.5
Sale price of gunny bags (Rs. per bag)	10
Margin (%)	15
Interest on bank loan (% p.a)	12.50
Rearing period	6 wks
Cleaning period of shed	2 wks

C. Flock Chart

Years	1	2 to 8
No. of batches	7	7
Rearing weeks	40	42
Batches sold	6	7

D. Income and Expenditure Statement

Years	1	2 to 8	8
Income			
Sale of birds	7140000	8330000	8330000
Sale of manure	30000	35000	35000
Sale of gunny bags	2992	3142	3142
Total	7172992	8368142	8368142
Expenditure			
Cost of chicks	1617000	1617000	1617000
Cost of feed	4488000	4712400	4712400
Cost of medicines & misc. charges	612000	714000	714000
Insurance of birds	31500	36750	36750
Insurance of sheds and equipment	20375	20375	20375
Total	6768875	7100525	7100525
Surplus	1462192	1267617	1267617

**The recurring expenses for one cycle capitalised in the project cost and the same has not been netted out while arriving at the total expenditure for the first year. Hence, the same is included in the surplus for the first year.*

E. Calculation of NPV, BCR & IRR

Years	1	2 to 7	8
Capital Cost	3177000		
Recurring Cost	5710800	7100525	7100525
Total Costs	8887800	7100525	7100525
Income	7172992	8368142	8368142
Residual value of shed			764079
Total Benefit	7172992	8368142	9132221
Net Benefit	- 1714808	1267617	2031696
Disc cost at 15% DF	17766249		
Disc benefit at 15% DF	18569485		
NPW at 15% DF	**803236**		
BC Ratio	**1.05**		
IRR	**51.91%**		

CONCLUSIONS

All categories of broiler farmers have the same terms and conditions under a written contract which is more leaning towardsthe integrators than the farmers with a glaring practice of collecting two blank cheques (Gilbert et al.). And none of the integrators have insurance to cover the risk. Hardly any farmer has a copy of the written agreement and the document has little or no legal teeth in favour of the farmer in the court of law. The farmer gets a growing charge for steering the chicks from day one to marketable age. The base fee varies across firms ranging between Rs. 1.80 to Rs. 2.65 in addition to market price, production cost, and FCR linked incentives. The number of farmers contracted by each integrator varies between 60 and 300. The integrator practices like batch length, batch number and additional organic supplements have affected the net profitability of broiler contract farms.

REFERENCES

Behnke, R.H., Scoones, I. and Kerven C. (1993). Range Ecology in Disequilibrium. Overseas Development Institute/International Institute for Environment and Development Commonwealth Secretariat London.

Bojo, J. and Casells, D. (1995). Land degradation and rehabilitation in Ethiopia; A reassessment. AFTES

F. Repayment Schedule

Year	Loan	Gross surplus	Interest	Principal	Total repayment	Surplus	Balance outstanding at the end of the year
1	2700450	1462192	337556	337556	675113	787080	2362894
2	2362894	1267617	19869	337556	357425	910191	2025338
3	2025338	1267617	17499	337556	355055	912561	1687781
4	1687781	1267617	14844	337556	352400	915216	1350225
5	1350225	1267617	11871	337556	349427	918189	1012669
6	1012669	1267617	8541	337556	346097	921519	675113
8	337556	1267617	4812	337556	342368	925248	0

Working Paper 17. World Bank Washington D.C.

NARESH K.MALHOTRA, Marketing Research and Applied Orientation, Prentice Hall India Private Limited, 4th edition,(2005), p-568.

GILBERT, A.C. Marketing Research, The Dryden Press, Illinios, (1979), p-557

Indian Institute of Management, Financial Analysis of Public Enterprises in India, Bangalore, (1978), p .31.

PRASAD, K.V.V., REDDY, P.V.V.S., RAO, K.S. and RAGHU RAM, Problems in Contract Broiler Farming as Perceived by the Farmers. Indian Veterinary Journal,(2005).

Sidahmed, A.E. (1996). The rangelands of the arid/semi-arid areas: Challenges and Hopes for the 2000's Keynote Address to the Symposium on Range Management, The International Conference on Desert Development in the Arab Gulf States. KISR, Kuwait. March 1996.

Steinfeld, H. (1988). Livestock Development in Mixed Farming Systems. Kieler Wissenschaftsverlag Vauk, Kiel. Germany.

THURSTONE, L. Multiple Factor Analysis, University of Chicago Press, Chicago, (1959), p-508 to 509.

Wood Ash: an Alternative of Inorganic Lime to Ameliorate Soil Acidity

Ganesh Chandra Banik

Department of Soil Science and Agricultural Chemistry,
Uttar Banga Krishi Viswavidyalaya,
Pundibari, Cooch behar, West Bengal-736165, India
Email: gcbanik79@yahoo.co.in

Non-judicious application of inorganic liming materials for the management of soil acidity further creates problems in plant nutrient dynamics in soil, namely the deficiency of cationic micronutrients, toxicity of cationic secondary nutrients, reduced availability of phosphorus, potassium, boron etc. Thus, it is now a great need to search the alternative of the inorganic lime to manage soil acidity for productivity sustenance. The wood ash can replace the use of inorganic lime to some extent for the increment of pH of acid soil to desired level of crop production. The wood ash is easily available free of cost at rural house hold.

INTRODUCTION

Acidification of the soil is a major problem now-a-days. Worldwide, soil acidification affects an estimated 30% of the total topsoil (Sumner and Noble, 2003). Furthermore, 75% of acid top-soils are also affected by subsoil acidity, and failure to address topsoil acidity may result in subsoil acidification of even neutral to alkaline soils (Sumner and Noble, 2003; Brown *et al.,* 2008). In India, acid soils constitute nearly one-third of the area under cultivation. Out of the 328 million hectares of geographical area of India nearly 145 million hectares is cultivated and a rough estimate indicates that 48 million ha of soil is acidic in nature of which 25 m ha has pH below 5.5 while about 23 m ha has pH between 5.6 and 6.5 (Panda 1987; Bhat *et al.*, 2007). Acid soils are widely distributed in Himalayan regions, Eastern, North-Eastern and in Southern states under varying climatic and environmental conditions. Soil acidity has been recognized as an important agricultural problem, which adversely affects the crop production, directly or indirectly. One of the major problems of the soil acidity is the nutrient imbalance including the micronutrient deficiency in the soil available pool.

Problems of soil acidity

Acid soil is categorized as the problem soil for crop production because of

- Increased toxicity of aluminium
- Toxicity of iron and manganese causing browning disease particularly for submerged rice
- Reduced availability of phosphorus due to fixation
- Toxicity of iron, copper, zinc etc

- Reduced availability of molybdenum and boron
- Reduced population of beneficial bacterias and increased population of different disease causing fungi
- Reduction of symbiotic nitrogen fixation caused due to lowering activity of *Rhizobium*
- Increased loss of nitrogen by reducing the nitrogen fixation capacity activity of *Azotobacter*
- Occurrence of different diseases, namely root rot of tobacco, blight of potato etc.

Management of acid soil

The acid soils are normally managed by using the agricultural liming materials containing calcium. Few important of those are burned lime [CaO], slaked lime [$Ca(OH)_2$], calcite [$CaCO_3$] and dolomite [$CaMg(CO_3)_2$]. The quality of these limes is normally determined by four factors:

- Moisture content
- Neutralizing value (NV)
- Purity
- Particle size

Neutralizing value and particle size determine the equivalent neutralizing value (ENV) or neutralizing index (NI) of agricultural lime. The moisture content of agricultural lime is ignored when determining ENV because it is usually less than 2 per cent and does not have a significant effect on rate of application. The neutralizing value of liming materials is the per cent calcium carbonate equivalence (% CCE). A liming material with a higher NV value will have a greater effectiveness than one with a lower NV value. Impurities, such as clay and organic matter that naturally occur in liming materials, produce variations in NV among various liming materials.

What is Wood Ash?

Wood ash is the inorganic and organic residue remaining after combustion of wood. The composition of wood ash depends on many factors. Hardwoods usually produce more ash than softwoods, and the bark and leaves generally produce more ash than the inner woody parts of the tree. On average, the burning of wood results in 6 to 10 percent ashes. When ash is produced in industrial combustion systems, the temperature of combustion, cleanliness of the fuel wood, the collection location, and the process can also determine the composition of ash. Ash contains many major and minor elements few of which are beneficial for growth of crops. Wood ash also has some elements that pose environmental problems.

Application of wood ash as a liming material

Wood ash currently dumped as landfills or spread in the soil has the potential use as the alternative of agricultural lime to ameliorate soil acidity. Wood as can substitute lime as it contain significant amount of calcium in available form. The neutralizing value of wood ash ranged from 40-60%. Furthermore, it can serve as an excellent organic source of potassium (5-7%) and phosphorus (1-2%). Hardwood ashes contain more potassium than those from softwood It also contain 25-50% calcium.

The dose of wood ash as liming material

The dose of wood ash as alternative liming materials can be calculated by following equation

$$Rate\ of\ Ash = \frac{100}{CCC\ of\ Ash} X \frac{100}{100 - moisture\ \%\ of\ Ash} X\ Lime\ requirement$$

The lime requirement of the particular soil can be analyzed by SMP-buffer method. In general wood ash requirement is considerably higher than the lime addition to increase the same pH level in acid soil.

Other wood ash benefits

- Besides acting as a good source of lime it has many other soil health related benefits like
- Wood ash increases the organic matter and calcium content in soil. Both are superb binding agent for the generation of good soil structure. Thereby addition of wood ash increases the soil tilth condition particularly for low organic rich soil. Soil fertility
- Wood ash can control weed by if applied before land preparation
- It adds plant nutrient in soil like Ca, Mg, K and P
- Its cost is very low and is easily available in rural household
- It is more soluble and reactive than ground limestone

Precaution while using wood ash as liming material

- Wood ash is a caustic substance (very alkaline). Therefore it needs to wear personal protective equipments like goggles, hand gloves, dust musk, protective cloths etc. while applying wood ash in soil
- The dry ash must be covered during transportation and storage
- Fresh dry ash is very difficult to spread because of its dustiness. Therefore, water should be added before its spraying in the field
- Avoid contact between freshly spread ashes and germinating seed
- If ash is applied on standing crop by spraying it can settle on foliage that cause burning. Prevent this by thoroughly rinsing the plant after applying ashes.
- It overused or misused it can cause crop damage

CONCLUSION

The wood ash not only acts similar to inorganic lime in the soil to decrease the acidity problem but also increase soil productivity by adding different plant nutrients particularly Ca, P and potassium. It also increases the phosphorus availability in acid soil by decreasing P-fixation in acid soil. But the landowners must follow the prescribed application rates and take definite precaution to avoid environmental contamination.

REFERENCES

Bhat JA, Mandal Biswapati and Hazra GC. 2007. Basic slag as a liming material to ameliorate soil acidity in Alfisols of sub-tropical India. *American-Eurasian Journal of Agriculture & Environmental Science* 2: 321-327

Brown TT, Koenig RT, Huggins DR, Harsh JB and Rossi RE. 2008. Lime Effects on

Soil Acidity, Crop Yield, and Aluminum Chemistry in Direct-Seeded Cropping Systems. *Soil Science Society of America Journal* 72: 634-640

Panda N. 1987. Acid soils of Eastern India - Their chemistry and management. *Journal of Indian Society of Soil Science* 35: 568-581

Sumner ME and Noble AD. 2003. Soil acidification: The world story.. *In* Z. Rengel (ed.) Handbook of Soil Acidity. Marcel Dekker, New York. pp. 1–28.

Fluorosis: An epidemic hazard and its consequences on livestock population

P. Samal[1], D. Jena[2*], A. Mahapatra[3], D. Sahoo[4] and S. Behera[5]

[1]Department of Clinical Veterinary Medicine, [2]Department of Animal Reproduction, Gynaecology and Obstetrics, C.V.Sc. & A. H., OUAT, Bhubaneswar – 751003
[3]Department of Veterinary Anatomy, Madras Veterinary College, TANUVAS, Chennai-07
[4]Department of Veterinary Pathology, Madras Veterinary College, TANUVAS, Chennai-07
[5]Divison of Veterinary Bacteriology and Mycology, IVRI, Izatnagar - 243122
*Corresponding Author: krishna5dj@gmail.com

Abstract

Fluorosis, a throbbing environmental issue, affects not only the human being but it also inflicts severely to the animals in a very bitter way with cascade of events ranging from various health hazards to economic aspects. The increasing trend in industrialization and soaring population rate is giving a shot in the arm to the predisposing and anthropogenic factors which are directly or indirectly responsible for hastening the process of fluorosis in a particular area. Fluoride is one of the essential component which an individual's body requires for proper functioning of various body mechanisms but in a contrast, when it is consumed for more than a required level and for a prolong period of time it affect the individual squarely with its deleterious effects. Several plausible natural and anthropogenic factors govern the out coming of the signs and symptoms of the fluorosis which is manifested in three forms naming dental fluorosis, skeletal fluorosis and non-skeletal fluorosis. The effects of fluorosis on the body may be a decrease in the ruminal flora accompanied with reduced appetite and production, inhibitory action on ameloblasts and odontoblasts during tooth formation, alteration of mineralization and remodelling of bone along with osteomalacia, osteoporosis, and exostosis formation and anemia, as a result of toxic depression of bone marrow activity. In a nutshell, the issue of fluorosis needs an urgent attention from various corners of our society in order to nullify its adverse effect along with a more scientific analysis and in time intervention of the disease process through alternative measures can benefit in minimizing sufferings and losses in man and animals.

INTRODUCTION

Environmental pollution is one of the vexed global issues in present scenario and is posing a serious threat to mankind and animal health aspects besides causing severe disturbances in the ecosystem. Most of the problems of the population emanating from livestock have remained confined to developed nations although it is slowly grasping the developing nations in an alarming rate. Albeit fluoride is required for the body metabolism, as in case of other minerals and essential metals, excess and chronic intake leads to warming signs of fluoride intoxication. High levels of fluoride in drinking water have become a potential health hazard in many parts of the world, with approximately 66.62 million victims

in India alone. Fluoride is an electronegative element, distributed ubiquitously as fluoride in nature and in combination, it comprises 0.065% of earth's crust . It does not exist in elemental state and is non-biodegradable. Fluorosis is characterized by chronic fluoride intoxication and it is endemic in areas where fluoride content in drinking water and fodder are high. It is not merely caused by excess intake of fluoride but there are many other attributes and variables which determine the onset of fluorosis in animal population. The amount of fluoride in the water, local environment (temperature and humidity), other dissolved salts in drinking water, duration of exposure, age, health status, stress factors and the biological response of individual dictate the trend of prevalence. When more than one-fifth (20 %) of the animal population surveyed in a known high fluoride area shows positivity to fluorosis, it indicates the endemicity for the fluorosis.

Sources of fluoride poisoning:

According to the availability, sources can be broadly divided into two major groups. These are

1. Natural Sources
2. Artificial or Anthropological sources

Natural Sources:

Fluoride bearing rocks: Fluoride bearing rocks are abundant throughout India. The fluoride from the rocks leaches out and contaminates the adjacent water sources, soil, and the vegetation of that area and upon consumption of that contaminated water or vegetation the animal becomes the victim of fluorosis after a period of time span.

Volcanic eruptions: Dust and gases from volcanic eruptions may also be associated with acute fatal fluorine intoxication in the period immediately after the eruption, and contamination of pasture may be sufficient to be associated with subsequent chronic intoxication in animals eating the herbage, although the fluorine content of the contaminated materials decreases very rapidly if rain falls. Iceland is particularly afflicted with fluorine intoxication deriving from this source.

Artificial Sources:

There are a number of artificial sources of fluoride are there, which includes –

- Aluminium smelters plants
- Superphosphate fertilizer plants
- steel and copper smelters
- Glass, ceramic industries
- Cement factories
- Brick kiln units
- Burning of coal fire
- Crushing industries etc

Fluorides in the body:

- Fluoride enters the body mainly through drinking water. 96-99% of it combines with the bones as fluoride has an affinity for the calcium phosphate in the bones.
- Approximately 75–90 per cent of ingested fluoride is absorbed in the blood. About three-fourths of the fluoride in blood is contained in the plasma; the remainder is in the erythrocytes, which make up 40 to 50% of the blood volume.
- Once absorbed in blood, fluoride readily distributes throughout the body, with approximately 99 per cent of the body burden of fluoride

retained in calcium rich areas such as bone and teeth (dentine and enamel) where it is incorporated into the crystal lattice.

- Levels of fluoride that are found in the bone vary with the part of the bone examined and with the age and sex of the individual. Bone fluoride is considered to be a reflection of long-term exposure to fluoride.

Effect of fluorosis on animal body:

- Ingestion of toxic level of fluoride leads to reduction in the activity of ruminal micro flora, a reduction in food intake, and a decreased production of fatty acids.
- Inhibit the action of ameloblasts and odontoblasts during tooth formation, resulting in failure of the developing tooth to accept minerals
- Alter mineralization and remodelling of bone by replacing hydroxyapatite in the bone crystalline structure leading to exostoses.
- Bone lesions of osteomalacia, osteoporosis, and exostosis formation, with accompanying pathological fractures
- Anemia occurs as a result of toxic depression of bone marrow activity.

Clinical signs:

The lesions and clinical symptoms in animals closely resemble to man. The toxicity is clinically manifested in three forms, namely

a) Dental Fluorosis
b) Skeletal Fluorosis
c) Non Skeletal Fluorosis

Dental fluorosis:

The dental fluorosis is characterized by mottling of tooth enamel, erosion of teeth with appearance of pigmented spots, opaque chalk like areas; very light yellow, brown or black colored spots having linear pigmented streaks and pits or bands arranged horizontally across the teeth.

Fig.1. Pigmentation of teeth in a fluorotic cow

Skeletal fluorosis:

In skeletal form, the bone lesions like osteomalacia, osteoporosis, and hip lameness, stiffness of the limb, painful gait, and unthriftiness are the characteristic clinical symptoms. Periosteal hyperostosis or exostosis at joint or at places of attachment of ligaments and tendons causes pain and lameness.

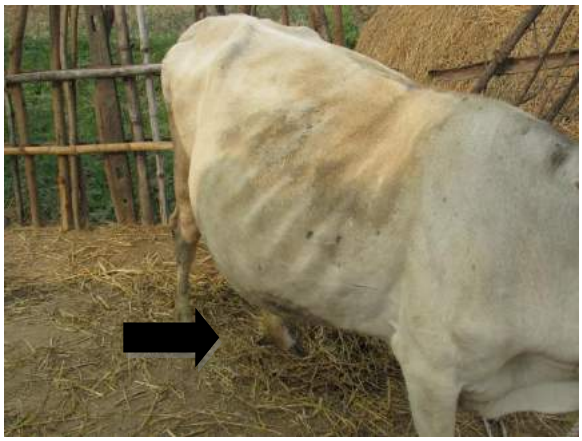


Figure 2. Exostosis of ribs in a fluorotic cow

Non-skeletal fluorosis:

In non-skeletal form, the effect is manifested in different forms like nervous form, muscular form, digestive form etc. Besides, clinical signs like cud dropping, intermittent or frequent diarrhoea, generalised emaciations, rough hair coat and hypo-glycaemia.

Diagnosis:

- Observing clinical signs.
- Plasma fluoride estimation (Normal: 0.2 mg fluorine per mg/dL)
- Urine fluoride estimation (Normal: 2-6 mg/kg in urine)
- Changes in haematological parameters: Anaemia (mostly normocytic normochromic), eosinophilia, decreased RBC count, decrease PCV etc.
- Radiographic changes: of bones containing more than 4000 mg/kg of fluorine include increased density or abnormal porosity, periosteal feathering, and thickening, increased trabeculation, thickening of the compact bone, and narrowing of the marrow cavity.
- Necropsy study: bones have a chalky, white appearance, are brittle and have either local or disseminated exostoses, particularly along the diaphysis.

Therapeutic management:

- Restricted free grazing and free drinking habits in the vicinity of aluminium smelter.
- Disposal of industrial wastes to grazing field and its surrounding should be prohibited.
- Removal of the source of poison.
- In acute cases gastrointestinal sedatives and demulcents to prevent acute pain.
- An intake of 1-1.5 mg/kg body weight fluorine is the maximum safe limit advisable in ruminants.
- Bone meal is a rich source of fluorine, hence it must be used cautiously.
- Fluoride content of water sources like pond, river, tube-well and bore well etc. should be estimated before use.
- Besides that, several studies have been conducted to ameliorate fluorosis, such as chemicals- calcium, boric acid, aluminium, selenium, etc. Use of chemicals which reduce fluoride burden is not without its associated side effect.
- Considering above factors new researches have been carried out to ameliorate fluorosis by using herbal preparations like Tamarind pulp (Emli), Mango fruit, Amla, etc.

Conclusion:

The deleterious effects of chronic fluorosis are mostly irreversible. Thus, heavy economic losses occur in terms of reduced productivity, reduced draught power capacity and the animals survive in very precarious and miserable condition till death which is ethically deplorable. Therefore, scientific study of newer emergent fluorosis areas and timely intervention of the disease process through alternative measures can benefit in minimizing sufferings and losses in man and animals.

REFERENCES

Choubisa SL. 2008. Dental fluorosis in domestic animals, Current Sci, **95**: 1674-1675.

Dwivedi SK Dey S and Swarup D. 1997. Hydrofluorosis in water buffalo in India, Sci. Total Eviron, 207: 105-109.

Gupta AR, Day S, Swarup D, Saini M, Saxena A and Dan A. 2013. Ameliorative effect of Tamarindusindica L. on biochemical parameters of serum and urine in the cattle from fluoride endemic area, Veterinarski archive, 83(5): 487-496.

Kerur VK. 1971. Fluorosis in cattle, Indian Vet.J, **48**: 200-203.

Patra RC, Dwivedi SK, Bhardwaj B and Swarup D. 2000. Industrial fluorosis in cattle and buffalo around Udaipur, India, Sci. Total Environ, **253**: 145-150.

Radostits, O.M., Gay, C.C., Blood, D.C., and Hinchcliff, K.W. 2000, Veterinary Medicine. IX Edn., W.B. Saunders. ELBS, London.

WHO.1984. Environmental health criteria for fluorine and fluorides. Geneva. 1-136.

Role of Plant Growth Regulators on Crop Production of Horticultural

Akula Venu*, Mayure, G[1]., Solanki, D. R[2]., Singh, T[3].and Bhalani, R.B[4].

*13&4Ph.D Scholar, Dep. Of Horticulture, COA, J.A.U., Junagadh-362001
2M.Sc (Agri) Scholar, Dep. Of Agri. Chem& Soil Sci., COA, J.A.U., Junagadh-362001
E-mail-venunaiduhorti038@gmail.com

Plant growth regulators (PGRs) are organic compounds, other than nutrients, that modify plant physiological processes. PRGs, called biostimulants or bioinhibitors, act inside plant cells to stimulate or inhibit specific enzymes or enzyme systems and help regulate plant metabolism. They normally are active at very low concentrations in plants.The importance of PGRs was first recognized in the 1930s. Since that time, natural and synthetic compounds that alter function, shape, and size of crop plants have been discovered. Today, specific PGRs are used to modify crop growth rate and growth pattern during the various stages of development, from germination through harvest and post-harvest preservation.Growth regulating chemicals that have positive influences on major agronomic crops can be of value. The final test, however, is that harvested yields must be increased or crop quality enhanced in order for PGRs to be profitable.

Of the many current uses of PGRs, effects on yield are often indirect (Morgan. 1979). Some of these uses include: (1) Increasing flowers in fruit and vegetables, (2) preventing preharvest fruit drop, (3) synchronizing maturity to facilitate mechanical harvest, (4) hastening maturity to decrease turnover time, and (5) reducing labor requirements. Studies conducted on major grain crops, such as com, soybean, wheat, and rice, have identified materials capable of altering individual agronomic characteristics like lodging, plant height, seed number, and maturity. Even so, these changes have not always resulted in increased yields.

Plant growth regulators are chemicals applied by a horticulturist to regulate plant growth. In plant propagation, cuttings are dipped in a rooting hormone to stimulate root development. In greenhouse production, many potted flowering plants (like poinsettias and Easter lilies) may be treated with plant growth regulators to keep them short.

Seedless grapes are treated with plant growth regulators to increase the size of the fruit. In special situations, turf may be treated to slow growth and mitigate the need for mowing. Because plant growth regulators are effective in parts per million or parts per billion, they have little application in home gardening.

CLASSES OF GROWTH REGULATORS

PGRs may be naturally occurring, plant produced chemicals called hormones, or they may be synthetically produced compounds. Most PGRs, natural and synthetic, fall into one of the following classes:

- ***Auxins*** primarily control growth through cell enlargement, although there are instances of auxin-induced cell division. They may act as both stimulators and inhibitors of growth, and cause different plant parts (shoots, buds, and roots) to respond differently. For example, at low concentrations, the auxin-like herbicide 2,4-D stimulates cell enlargement, whereas at higher concentrations, it inhibits enlargement or is even toxic to cells. Auxins also stimulate differentiation of cells, the formation of roots on plant cuttings, and the formation of xylem and phloem tissues.
- ***Gibberellins*** control cell elongation and division in plant shoots. They have been shown to stimulate ribonucleic acid and protein synthesis in plant cells.
- ***Cytokinins***act in cell division, cell enlargement, senescence, and transport of amino acids in plants.

For the specific regulation of many plant processes and the differentiation of cells into specific plant parts, a variety of ratios and concentrations of these three plant hormone classes are required rather than a single hormone acting alone.

Other naturally occurring regulators of plant growth and plant metabolic activity can be classed as inhibitors and ethylene.

Inhibitors represent a wide assortment of internally produced chemical compounds, each of which inhibits the catalytic action of a specific enzyme. Since a plant cell may contain as many as 10,000 different enzymes, there are a wide variety of inhibitors acting inside the cell.

Ethylene is internally produced by plants and has a multitude of effects on cell processes. It interacts with auxins to regulate many metabolic processes. Several chemical compounds that release ethylene after being sprayed on plants are currently commercial PGR products.

A wide assortment of plant growth-promoting products are being marketed with claims made for beneficial effects on crop growth and yields. Typically, these products are supposed to: (1) promote germination and/or emergence, (2) stimulate root growth, (3) promote mobilization and translocation of nutrients within plants, (4) increase stress tolerance and improve water relations in plants, (5) promote early maturity, (6) increase disease resistance, (7) retard senescence, or (8) improve crop yields and/or quality.

Usually, the claims are made for plant hormone products or products that affect the concentrations and ratios of plant hormones internally. Most often, the ingredients in these products are found to be:

- Extracts from bacteria, yeast, fungi, marine algae, and sea kelp. Usually, low concentrations of auxin, gibberellin, and cytoki-nin and adenine, or adenosine monophosphate (AMP) are claimed.
- Adenine, AMP, and cyclic AMP.

- Indole butyric acid and/or indole acetic acid. Both of these are auxins.
- Gibberellins—a family of approximately 70 chemical compounds.
- Cytokinins—6 furfuryl-amino purine, 6-benzyl-amino purine, zeatin, dihydrozeatin, and 20
- otherrelated chemical compounds.
- Polyethylene glycol.
- Dinoseb—2-sec butyl-4,6-dinitrophenol.
- Proteins and/or amino acids.
- Carboxylic, phenolic, and/or humic acids.

These products may provide some of the eight benefits listed above when applied to field crops grown in growth chambers or greenhouses. However, results obtained under carefully controlled conditions are not easy to reproduce in the field (Rappaport, 1980). Effects of environment, crop management, and variety on crop responses and yields are usually much more pronounced than the effects of PGRs. This makes it difficult to demonstrate a yield or quality response to the application of a PGR.

EFFECTS OF PGRS ON CROP GROWTH

Germination And Emergence

Several plant hormones have been shown to affect germination of seeds of some plant species (Nickell, 1982). The primary event of breaking seed dormancy is stimulated by gibberellins. Thus, dormancy is not a factor in stand establishment. Volunteer plants of field crops, which begin growing after harvest, attest to the fact that PGRs that break dormancy are not required to aid germination.

While germination of several crop species has been increased by gibberellic acid, indole acetic acid, succinic acid, and fusiococcin, all treatments required seed soaking to incorporate the chemical into the seed. Soaking initiates water imbibition, germination, and softening of the seed, which makes planting with current planters difficult.

For most crops, poor seedling emergence through soil crusts, dry soils, and cold soils is more of a problem than is poor germination. Large-seeded broadleaf crops emerge by an elongating hypocotyl dragging large cotyledons through the soil. Some short-statured This prevents their use in dry soils, where seeds must be planted deeper than 2 inches to come in contact with moisture.

Data on the effects of PGRs on emergence are very limited, although gibberellic acid has been shown to increase seedling height of beans, tomato, and soybean. It is not known if gibberellic acid increases the force exerted by seedlings against the soil to aid emergence. Seedlings emerging under stress of a soil crust produce ethylene, which results in thickened hypocotyls and greater emergence force.

Currently, seed treatments of commercial value are used as protectants from diseases, insects, and herbicides. Commercially important seed treatments include fungicides, insecticides, and seed safeners. Safeners are chemicals that protect seedlings so a herbicide can be used on a susceptible crop.

HORMONE INFLUENCE ON PRUNING

Understanding hormones is key to proper pruning. Auxin produced in the terminal buds suppresses growth of side buds and stimulates root growth. Gibberellins produced in the root growing tips stimulate shoot growth. Pruning a newly planted tree removes the auxin, slowing root regeneration.Heading cuts (removal of a branch tip) releases the apical dominance caused by auxins from the terminal bud. This allows side shoots to develop and the branch becomes bushier. On the other hand, thinning cuts remove a branch back to the branch union (crotch). This type of cut opens the plant to more light. Most pruning should be limited to thinning cuts. For details on pruning, refer to CMG Pruning fact sheets.

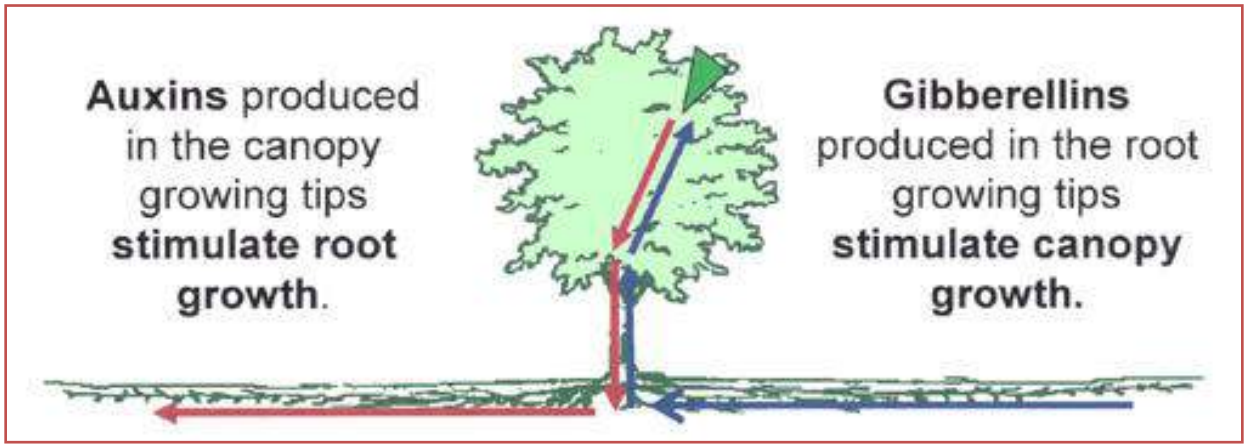


Figure 1 Tree balance canopy growth with root growth by concentrations of auxinx and gibberellins

ROOT GROWTH

Several PGRs in the auxin family of chemicals will stimulate root initiation on plant cuttings. These PGRs are commonly used for horticultural crops (Nickell, 1982). Indole butyric acid is the most frequently used PGR because it is not rapidly degraded by the plant and is not translocated from the site of application.

Some claims for increased root growth from use of PGRs are made as a result of studies where plants are pulled from the soil. The roots that remained attached are visually examined and compared with treated and non-treated plants. These roots are often broken off within 6 inches of the base of the stalk. Since any individual plant may have up to 1.25 miles of roots in the upper 5 feet of soil, root density within 6 or so inches of the stalk may not be representative of the total amount of roots for that plant.

MOBILIZATION AND TRANSLOCATION OF NUTRIENTS

Plant hormones influence mobilization of inorganic plant nutrients and sugars. Most experimental evidence that indicates plant hormones influence nutrient mobilization or translocation within plants comes from short-term laboratory studies.

Several of the "growth stimulant" products have been evaluated in field

studies in Wisconsin, Nebraska, Iowa, and Kansas on several field crops. Nutrient concentrations in plant parts were slightly increased, slightly decreased, or not affected by growth stimulants in the various trials. Nutrient concentrations in crops were increased to a greater extent by fertilizer additions in these trials than by the application of growth stimulants (NCR-103 Committee, 1976).

Nutrient uptake in horticultural crops from the soil is affected by eleven factors relating to both plant and soil parameters (Barber, 1984). These include: (1) root length, (2) rate of root growth, (3) root radius, (4) maximum rate that roots can take up a nutrient, (5) rate when nutrient uptake is half-maximal, (6) minimum concentrate of a nutrient in the soil solution where uptake begins to occur, (7) nutrient concentration in the soil solution, (8) the soil's ability to replenish the soil solution with the nutrient, (9) diffusion rate of the nutrient in soil solution, (10) rate of water uptake by roots, and (11) distance between competing roots, including their root hairs. Nutrient uptake is a complex process with many interacting factors and is difficult to influence by foliar or soil applications of low concentrations of PGRs.

STRESS TOLERANCE AND MOISTURE RELATIONS OF CROPS

Tolerance to soil moisture stress in crops is related to a crop's ability to control transpira-tional water loss from leaf surfaces. The opening and closing of stomata, relative numbers of stomata per unit leaf area, and thickness of the cuticle layer influence transpiration rates. Various attempts to decrease water losses from plants include: (1) PGRs that regulate the closure of stomata during moisture stress, (2) chemicals that form water-barrier films over the upper and lower surfaces of plant leaves, and (3) PGRs that decrease plant topgrowth and increase the root/shoot ratio to decrease water usage by the plant (Gale and Hagan, 1966).

Several chemicals have short-term effects, lasting from several hours to several days, on stomatal closure. Among these chemicals are phenyl mercuric acetate, atrazine, alachlor, chlormequat, daminozide, indole acetic acid, and abscisic acid. Chemicals that close sto-mata have sometimes increased crop yields when crops were grown under moisture stress. However, they decreased yields when crops were grown without stress. Closure of stomata limits entry of carbon dioxide into leaves; photosynthesis is decreased as well. Thus, there are trade-offs when attempting to use growth regulators to decrease transpiration.

Chemicals that form barriers to water loss have also resulted in inconsistent yield responses. Oil-wax mixtures, vinyl acetate-acrylate copolymers, hydrocarbon films, latex, and silicon polymers coat the leaf surfaces to prevent evaporation of water. Some coatings tend to plug stomata and decrease entry of carbon dioxide, which decreases photosynthesis and plant growth. In most cases, both upper and lower leaf surfaces must be coated with water-barrier films in order to effectively increase yields under

moisture-stressed growing conditions (Fuehring and Finkler, 1984).

Growth retardant PGRs decrease top growth/root mass ratios and decrease transpiration. Chlormequat and other PGRs that inhibit gibberellin synthesis in plants may increase crop yields when crops are grown under moisture stress, but decrease yields when crops are grown with adequate soil moisture. These PGRs decrease water consumption at the expense of absolute production. Most chemicals that have shown efficacy for decreasing water use are not found in the list of typical ingredients for growth stimulants. Onlyindole acetic acid as an agent that closes stomata is on this list.

MATURITY

Since crop maturity is related more to genetic control than to environmental control, an early-maturing hybrid or a variety with a shorter growing season requirement can be grown, if desired.Over 50 chemicals have been tested as sugarbeetripeners, and several are in commercial use. In sugarbeet, PGRs are used for uniform ripening, which improves sugar accumulation. Several PGRs and herbicides have been tested on cotton to promote uniform boll opening, which aids in mechanical picking and improves quality of the lint. These PGRs, however, are not found on the list of typical ingredients for growth stimulant products.

DISEASE RESISTANCE

Changing the metabolism of plants with PGRs to control disease has provided mixed results. Some of the auxin materials have given positive results, while gibberellins have both increased and decreased disease severity (Nickell, 1982).

Disease resistance in crop plants is a heritable characteristic of considerable economic importance. Plant breeders are continually working to incorporate new sources of disease resistance into crop varieties. Genetic expression of disease resistance is often a localized response to invasion by the causal organism. The plants produce a toxic substance to kill the microorganisms that cause the disease. Disease resistance is not due to changes in plant hormone concentrations or ratios in infected cells. Claims for plant growth stimulants improving disease resistance in crop plants are largely unsubstantiated.

SENESCENCE

Senescence is the natural termination of plant processes during the development of the seed, and is regulated by several metabolic and environmental signals. In laboratory studies with leaves, senescence was retarded by auxins, gibberellins, and cytokinins and accelerated by abscisic acid and ethylene. In plants growing in controlled environments, as many as 14 control signals or influences have been identified that affect vegetative senescence during reproductive development (Goldthwaite, 1987).

Senescence delay in corn can be genetically manipulated. Several hybrids currently possess a stay-green characteristic for the leaves. When compared to hybrids of similar genetics without the stay-green characteristics, they often have slightly lower grain yields. This

is because the hybrids without the stay-green leaves will mobilize and translocate carbohydrates and nutrients from the leaves and stalk to the grain to a greater degree than the hybrid with stay-green leaves. Thus, retarding senescence is not necessarily related to crop yield increases. Applications of plant hormones either in the soil or as a foliar spray on the crops has less influence on senescence than environment and plant genetics.

CROP YIELD AND QUALITY

Commercial applications of plant hormones have been limited to the use of gibberellic acid in fruit production. Both indole acetic acid and cytokinins are broken down very rapidly by microorganisms to inactive products when applied in the soil or on the foliage of plants. Restricted penetration of the cuticle and entry into plant cells has been another problem with indole acetic and cytokinins.

Gibberellic acid is foliar applied on seedless grapes to loosen the cluster, decrease diseases, and increase berry size. It is also used on the "Delicious" apple to control fruit shape, on lemons to delay ripening, on sugarbeet to increase both elongation and sugar yields, on artichokes to accelerate flower bud production, and on celery to increase petiole elongation during cool weather conditions.

The PGRs that have been studied for increased yield or quality of horticultural crops are dinoseb, 2,3,5-triiodobenzoic acid (TIBA), ethephon, chlormequat, and mepiquat. Dinoseb applications on coriander at low concentrations as a biostimulant have produced erratic grain yield responses. Yields have been increased by 5 to 15% in some studies, whereas no yield responses have been observed in other trials (Oplinger, 1983).

Ethephon on small grains provides protection from lodging and increases yields if lodging is prevented during the early part of grain-fill. In addition, it aids in mechanical harvest of small grains. Chlor-mequat is another anti-lodging agent for small grains crops; it is used in Europe as a crop protectant (Jung and Rademacher, 198!)). Mepiquat is applied on chilli as a growth retardant to prevent excessive vegetative growth and increased fruit set. However, PGRs have come into wider usage on horticultural crops because of consistencies in yield or quality improve-ments when they are used.

REFFERENCE

Barber, S.A. 1984. Soil nutrient bioavailability: a mechanistic approach, p. 118. John Wiley and Sons, New York.

Barber, S.A. 1986. Environmental influence on com root distribution. Indiana Plant Food and Agric. Chem. Conf., Proceedings, p. 2-5.

Cole, D.F. and J.E. Wheeler. 1974. Effect of preger-mination treatments on germination and growth of cotton seeds at suboptimal temperatures. Crop ***Sci.*** 14:451-454.

Fuehring, H.D. and M.D. Finkner. 1984. Effect of Folicoteantitranspirant application on field grain yield of moisture-stressed corn. ***Agron. J.*** 75:579-582.

Gale, J. and R.M. Hagan. 1966. Plant antitran-spirants. ***Ann. Rev. of Plant***

Physiol. 17:269-282.

Gianfagna, T.J. 1987. Natural and synthetic growth regulators and their use in horticultural and agronomic crops, p. 614-635. In P.J. Davis (ed.) Plant hormones and their role in plant growth and development. MartinusNijhoff Publishers, Dor-decht, Boston, Lancaster.

Goldthwaite, J.J. 1987. Hormones in plant senescence, p. 553-573. In P.J. Davis (ed.) Plant hormones and their role in plant growth and development. MartinusNijhoff Publishers, Dordecht, Boston, Lancaster.

Jung, J. and W. Rademacher. 1983. Plant growth regulating chemicals—cereal grains, p. 253-271. In L.G. Nickell (ed.) Plant growth regulating chemicals. Vol. I. CRC Press, Inc. Boca Raton, FL.

Kellerhalls, M. 1986. Effect of plant growth regulator combinations on faba bean growth and vield structure. Ph.D. diss. *(Diss. Abstr. Int.* C. 47:597-598).

Mackay, A.D. and S.A. Barber. 1985. Soil moisture effects on root growth and phosphorus

Morgan, P.W. 1979. Agricultural uses of plant growth substances: an analysis of present status and future potential. Plant Growth Regulator Working Group, Proceedings. 6:1.

NCR-103 Committee. 1976. Compendium of research reports on use of non-traditional materials for crop production. North Central Region. American Society of Agronomy. Madison, WI.

Nickell, L.G. 1982. Plant growth regulators, agricultural uses. Springer-Verlag. Berlin, Heidelberg. New York.

Oplinger, E.S. 1983. Corn. p. 131-137. In L.G. Nickell (ed.) Plant growth regulating chemicals, Vol. II. CRC Press, Inc. Boca Raton, FL.

Barbervax-First sub-unit vaccine in world against gut dwelling sheep parasite

Anil Kumar[1], Chaudhary Gangaram[2], Abhinav Suthar[3] and P.G. Soni[4]

[1,2,&3]*Ph.D. Scholar, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh-243122*
[4]*Ph.D. Scholar, National Diary Research Institute, Karnal, Haryana-132001*
*Corresponding Author: anilnehra15@gmail.com

Barbervax has been developed after many years of research at Moredun Research Institute, Edinburgh, Scotland and the recent collaboration with Albany laboratory of the Department of Agriculture and Food, Western Australia; the world's first sub-unit vaccine against the most important nematode causing substantial economic losses to small ruminant industries i.e. *Haemonchus contortus*. It is developed by Moredun Research Institute and vaccination trials has been conducted in Merinos in the Northern Tablelands of New South Wales (NSW) because haemonchosis is only a sporadic problem in UK whereas in Australia, South Africa and South America, it is very extensive and presents a real difficulty to sheep farmers to control because strains resistant to anthelmintic drugs are common and widespread. Extensive financial support is received from Meat and Livestock Australia (MLA).

Approval from the Australian Pesticide and Veterinary Medicines Authority to sell Barbervax for use in Australian lambs was obtained on October 1st, 2014 and was launched in mid-October, 2014 in Armidale in the NSW, where resistance to the majority of drench classes is reported, and long-acting drench types don't provide prolonged protection. It gives new weapon to the sheep industry for fighting against an old adversary. This provides a major alternative to drench-based control, and will help in managing anthelmintic resistance and is supposed to be of particular benefit in the major *H. contortus*-endemic regions, where frequent drenching is usually necessary to prevent sheep deaths, and where anthelmintic resistance has severely reduced drench options. The vaccine is not a complete alternative to drenching or conventional worm management. Some drenches are still required as is worm testing to check progress-though with time, and a continued vaccination program, monitoring needs may decrease. Also, it is not effective against scour worms.

It is strongly recommended that the worm egg counts should be used to check barber's pole burden and to monitor low egg counts periodically. Ideally, a mob worm test should be done 4-5 weeks after each vaccination from third vaccination onwards, so that the result is known before the next vaccine muster. The results will

inform whether a drench is required e.g. to control scour worms at the time of the next vaccination. Pasture management to circumvent significant barber's pole intake will further enhance the effectiveness of vaccination, and breeding of sheep genotypes resistant to parasitic infections provides longer-term worm control strategy. The vaccine will not be a 'silver bullet', but when used in a monitored control program it is expected to provide a significant new approach—at a competitive cost—for control of a very significant parasite. It is important that lambs vaccinated with Barbervax do not share their pasture with unvaccinated sheep or goats (except their mothers before weaning).

Currently, field vaccination trials are going on at 33 different places of the globe (Mexico, Switzerland, Sobral, Bage, Botucatu, Uruguay, Tanzania, Pretoria, Joburg and Australia (Albany and Armidale)). Initially, three lakh doses sufficient for 60,000 lambs were produced for use in Australia. Eventually, the vaccine will be marketed overseas for situations where barber's pole can't be easily or sustainably controlled without the excessive use of drenches. As no pharmaceutical companies are involved in production, all revenues are supposed to flow back to Moredun Research Institute for further future research (barbervax.com.au).

RESEARCH TEAM

Scientists involved in successful production and testing of this vaccine are:

1. David Smith (Moredun Research Institute, Edinburgh, UK)
2. Brown Besier (Department of Agriculture and Food, Albany, Western Australia)
3. Robert Dobson (Murdoch University, Western Australia)
4. Lewis Kahn (University of New England, Armidale, NSW)

VACCINATION SCHEDULE FOR LAMB

1. The 1st Barbervax vaccination should be given at lamb marking at or after 21 days of age.
2. The 2nd vaccination, 3-4 weeks later.
3. The 3rd vaccination, 3-4 weeks later, generally at weaning.

Note: It should be given with an effective drench to control scour worms (*Trichostrongylus* spp.) as well as any early barber's pole worm and the lambs should be moved to a prepared low worm-risk field, ideally where sheep have not grazed for several months. It is important to note that the first two vaccinations don't provide protection, but they prime the lamb's immune system so that protection occurs following the 3rd vaccination.

4. The 4th vaccination, 6 weeks after the third vaccination.
5. The 5th vaccination, 6 weeks after the fourth.
6. A 6th vaccination, may be required 6 weeks after 5th. It is optional.

The ground-breaking vaccine is currently registered for use in lambs and weaners, while use in hoggets and adult sheep is supposed to be approved very soon. Trials are proceeding in goats to confirm previous encouraging results. It is given as a series of 5 subcutaneous injections of 1 ml, irrespective of body

weight high on the neck behind the ear. Each 1 ml dose contains 5 µg native antigen and 1 mg saponin adjuvant. It is sold in 250 ml packs, the contents of which should be used within 12 hours of opening. Any vaccine remaining needs to be discarded. Its current unopened shelf-life is 20 months (this is expected to increase) and it should be kept refrigerated (2-8°C), but not frozen. It is safe for young lambs and heavily pregnant ewes alike (barbervax.com.au).

MECHANISM OF ACTION

Effectiveness of vaccine against helminth is dependent upon host's immune system to produce antibodies which will kill the parasite. When a sheep first receives Barbervax, three priming doses of the vaccine are required to reach an effective level of antibodies which is one more dose than for other vaccines used, and its protection lasts for 6 weeks after each dose. But, for sheep already vaccinated the previous year, priming occurs in about 10 days of first vaccination. It contains small amount of protein purified from the lining of *H. contortus* intestines. Like all vaccines, it works by stimulating the natural immune response in the animal after injection. The antibodies produced circulate in the sheep's blood, so that the parasites consume antibodies with their blood meals. These antibodies attach to the lining of the Barber's Pole intestine, blocking digestion and starving the worm so that it produces far fewer eggs and dies. It works where drenches fail against barber's pole worm due to drench resistance, and the history of other vaccines indicates that the worms are unlikely to become resistant to it indicating sustainability. It has been shown that injecting worm antigens or proteins extracted from the intestinal membranes of *H. contortus* into sheep provides high levels of protection; at the same time, the protective effects could not be reproduced when the specific proteins were produced in recombinant systems used for modern vaccine production. There will always be a tiny proportion of animals that do not respond to a vaccine, even when correctly given. The flock immunity will keep the worm challenge low and these few sheep, unless they are particularly susceptible to barber's pole worm, will generally stay healthy. Trials indicate that some immune memory persists so that the first injection in the second year restores the immunity gained from lamb vaccination, with 6-weekly boosters from then on. It also slows the development of anthelmintic resistance in all worm species (barbervax.com.au).

COST EFFECTIVENESS

The Barbervax vaccine is costing about Rs. 30 per dose, but it can't be used as single dose treatment. Priming doses are essential before it becomes fully effective, so it needs commitment of using- at least 4, but usually 5 doses for lambs/weaners. This equals to Rs. 120 or Rs. 150 per sheep (regardless of bodyweight). It is reasonably priced considering its prolonged effect, and will be even of better value in the second and subsequent years to each herd (when registered for use in older animals) as the primer doses are not required.

PROTECTION LEVEL

Extensive trial work done by Meat and Livestock Australia (MLA) shows that the

vaccine provides protection between 75 and 95%. In trials in NSW and Western Australia, vaccinated sheep maintained low barber's pole worm egg counts over summer and autumn, when worm egg counts in unvaccinated control sheep reached many thousands of eggs per gram. As the number of *H. contortus* larvae on pasture remains low due to the reduced worm egg output, even the small percentage of sheep which don't respond to vaccination (as happens with all vaccines) are not faced with significant larval intake. Computer modelling indicates that the vaccine is more than about 70% effective and if the priming vaccinations are given before heavy parasite burden develops, the vaccine regime over a 5-month season exclusively reduces the number of drenches required; 2-5 less short acting drenches or one less long-acting drench would be given (barbervax.com.au).

PROS AND CONS

On one hand, Barbervax is organic, non-toxic and has no withholding period or export slaughter interval, so it can be used without concern before animals go for slaughter. Secondly, if uncontrollable barber's pole worm infection persists and drenching is required very often during summer and early autumn, then this product is a superior alternative. On the other hand, it's not an annual one-shot vaccine. With a total of 4-5 doses required in the first year and only 6 weeks sustained effectiveness after the third and each successive dose, extra labour requirements to muster and treat might be significant (barbervax.com.au).

CONCLUSION

Barbervax will be of particular benefit in the major barber's pole-endemic regions, where frequent drenching is usually necessary to prevent sheep deaths, and where anthelmintic resistance has severely reduced drench options. It is important to understand that the first two vaccinations are not able to provide protection, but they prime the lamb's immune system so that protection occurs following the third vaccination, and lasts for at least 6 weeks. Further vaccinations need to be given after every 6 weeks. The third vaccination is generally done at weaning, in most cases with a drench to ensure that the vaccine is not over-whelmed by existing barber's pole burdens, and to control other worms such as black scour worm. MLA claims that the vaccine provides between 75 and 95% protection whereas computer modelling indicates that the vaccine is more than 70% effective. The vaccine does not replace the need for drenches, or the need for programs to control scour worms. Worm egg counts should be used to check barber's pole burdens. Injecting worm antigens extracted from the intestinal membranes of barber's pole worm into sheep provides high levels of protection against barber's pole infections. However, the protective effects could not be reproduced when the specific proteins were produced in DNA (recombinant) systems. It is manufactured by a research institute - no pharmas involved and profits are re-invested in research.

REFERENCE

barbervax.com.au - BarbervaX

Effect Of Housing System On The Behavior And Performance Of The Dairy Calves

Ankaj Thakur and Shailesh Kumar Gupta

PhD Scholar ICAR-NDRI Karnal Haryana
Corresponding author: ankajthakur27@gmail.com

Calves are the future income of the farm and sustainability of farm depend on them. Calf management, feeding and housing are important as they help calves in reaching their full genetic potential. Behavior, production performance and welfare of calves also need to be considered. Optimum housing can produce healthy replacement animals which can enter milking herd at a reasonable age adding profit to the farm.

TYPES OF HOUSING

Individual housing

- Individual feeding
- Reduced cross contamination
- Avoids competition
- Observation
- Labor intensive

Group housing

- Group behavior
- Social interaction
- Minimum stress if change infeed and environment
- Labor saving

Social housing

Early social interaction is important for normal social responses in later life. The social skills of individually penned calves can equal that of group reared calves if they are able to have visual contact with their peers. Young calves are highly motivated to seek social contact and early social contact may allow calves to better develop their social skills, which are useful later in life. Housing calves in groups allows them to perform their natural social behavior, provides more space for play and general activity and allows them to acquire social skills which improves their welfare

Contact seeking behavior

Individual calves more fearful than group housing calves. Grouped calves are also more confident and appeasing when they meet a new calf, compared to individually housed calves. Individual calves had a higher heart rate and were more reluctant to enter and to approach a new calf. Pair-housed calves and calves housed individually with visual and tactile contact of others, the pair housed calves approached a new calf more quickly. Group-housed claves are affected less to stressful procedures, including restraint and blood sampling, and vocalize less after being separated from their dam

Congnitive development

Socially housed calves appear to be able to learn how to use new automated feeding

equipment. Grouping at 8 weeks previously pair-housed calves quickly access concentrates and spent more time eating concentrates than previously individually housed calves when space at the feed manger was limited. Individual housing impairs cognitive performance in dairy calves.

Learning

Socially reared claves are smarter. Delay in individual housed calves to new technology like automated feeder learning difficulties can lead to trouble in routine and environment adjustments.Calves more time to begin eating grain from automated feeders in their new pens, while their pair-reared peers began eating normally within hours.

Play behaviour

Play behavior is used to indicate the presence of good welfare in calves and in juveniles of other farm animal species. Pair housed calves were able to use the larger pen area and rested more often and for longer durations on their side than individually housed calves

Cross sucking

A drawback to group housing for calves is that they can develop cross-sucking behaviors (cross sucking-redirection of natural sucking behavior towards peers). Group-housed milk-fed calves will sometimes suck each other (i.e., cross-sucking), but this cross-sucking can be greatly reduced or eliminated if calves consume their milk ration via free access to a teat, likely because the sucking behavior, rather than the ingestion of milk, is responsible for reducing sucking motivation.

How to prevent cross suckling

- Artificial teats
- Feed intake
- Reducing teat diameter
- Environment
- enrichment
- Automatic
- feeders
- Feeding area
- design

Agonistic behavior

Competition during milk feeding increases the risk of cross sucking, as motivation to suck is closely associated with motivation to drink milk. Sucking behavior, rather than the ingestion of milk, is responsible for reducing sucking motivation. Calves switch teats more when each teat is connected to a separate bucket than when all teats are connected to one large shared container, and providing the milk in separate buckets does reduce competition. However, giving each calf access to its own teat greatly reduced displacements. Improved access to teats resulted in longer feeding times and better milk intake

Performance

Social facilitation, when calves imitate each other's behavior, can result in a higher feed intake Group-housed calves also avoid the fluctuations in weight gain commonly experienced by individually housed calves, who may over-consume feed, causing discomfort and consequently a reduction in intake

Stress

Calves housed in groups or pairs are able to adjust to novel or stressful situations, such as weaning and mixing, more readily than

are individually housed calves. Barren environment may result calves to be more fearful to novel environment.

Health issues

Reduced transmission of pathogens in isolated calves while group-housed calves had a higher risk of respiratory disease. Infection occurs through Inhalation or faecal-oral contact mainly. The most common health disorders in calves are enteric and respiratory disease.

How we can prevent disease

- Clean bedding with proper ventilation
- Colostrum managementt
- Clean milk feeding equipment
- Space allotment and monitoring illness

Labor

In group housing the labor for feeding and cleaning calves in group housing is reduced.

Calves kept in groups required one-third of the labor compared to individual housing.

Pair housing

In Paired calves the incidences of agonistic behavior and cross-sucking were very low. Pairing housing of dairy calves at an early age increases solid feed intake and weight gain in comparison with individual and late paired calves. Pair-housed calves have a higher daily weight gain and begin eating solid feed nearly two days earlier than individually-housed calves and gained weight at a more stable rate. Housing dairy calves in pairs allows benefits such as increased space for movement and social opportunities with no disadvantages in health and weight gains

Optimum Group size

There is risk of spreading infection more in group housing. Therefore there is challenge of sanitation, managing nutrition and control disease in largegroups. Calves housed in large group pens had a higher risk for respiratory disease compared to calves in individual housing or small group pens. The ideal group size is 3-8, not exceeding 10 calves and different age groups should not be mixed

CONCLUSION

Calf housing is a tradeoff between health and behavioral freedom balance. Individual hosing avoids undesirable behaviors such as cross suckling and reduced disease transmission. Feeding system and group size is important in group housing. Stable groups improve growth rate, respiratory health and reduction in diarrhea. Early intakes of solids help to minimize weaning distress and improve calf performance afterweaning in group housed calves. There is a benefit of welfare, health and performance in group housing.

Hatchery Waste Disposal

Anjali Kumari[1], Rekha Yadav[2] and Ramadevi Pampana[3]

[1] Division of Livestock Production and Management, IVRI
[2] Division of Extension Eductaion , IVRI
[3] Division of Veterinary Parasitology, IVRI
Indian Veterinary Research Institute, Izzatnagar, Bareilly.
Corresponding author:anjali8992@gmail.com

Abstract

The land disposal of poultry waste and its subsequent environmental implications has stimulated interest into cleaner and more useful disposal options. Alternative disposal routes viz, rendering, composting, ensiling etc. has increased opportunities to market the energy and nutrients in hatchery waste to agricultural and non-agricultural uses. Common problems experienced by the current technologies are the existence and fate of nitrogen as ammonia, pH and temperature levels, moisture content and the economics of alternative disposal methods. Knowledge of the amounts and compositions of waste produced is essential for efficient and environmentally responsible management of these by-products as fertilizer, animal feed components or fuel. The best alternative should reduce power costs at plants and produce a range of value added products as well as promote environment sustainability.

Keywords: hatchery waste; Composting; disposal; ensiling

INTRODUCTION

Environmental protection act 1990 defined waste is a wide ranging term encompassing most unwanted materials. Waste includes any scrap material, effluent or unwanted surplus substance or article that requires disposal because it is broken, worn out, contaminated or otherwise spoiled. Hamm and Whitehead (1982) defined hatchery waste as all the collectible material remaining in commercial hatching trays after saleable chicks have been removed.The poultry industry produces large amounts of hatchery waste which includes solid waste and wastewater. Large quantities of hatchery waste needs to be disposed offevery day from the hatcheries.The solid hatchery waste comprises empty shells, infertile eggs, dead embryos, late hatchings and dead chickens and a viscous liquid from eggs and decaying tissue. The wastewater comes from water used to wash down incubators, hatchers and chick handling areas.

TRADITIONAL DISPOSAL METHODS

Hatchery waste management and disposalare serious problems for the hatchery industry. The material is difficult to hold for any periodof time because it decomposes readily. It isexpensive to haul because it is high in moisture.Disposal is usually a costly, undesirable operation.Traditional disposal methods for solid hatchery waste include land fill, composting, rendering, and incineration. Most of the hatchery waste is sent to land fill or composting. The costs of disposing

hatchery waste to land fill or for composting are increasing. In addition decreasingwaste disposal sites and environmental issues at hatcheries and at land fill sites has necessitated the need to examine alternative methods of handling and treating hatchery waste at hatcheries.The methods for wastewater disposal include sending it to land fill, using it for irrigation, disposing it directly into the sewer or into a wastewater lagoon. Some hatcheries use a wastewater treatment system. Land fill hatchery waste will break down naturally and produce methane which escapes to the atmosphere.

Challenges Associated with Disposal of Hatchery Waste

In other countries the cost is greater due to reduced areas available for landfill. The volume of hatchery waste that needs to be disposed of yearly is millions of tonnes. Disposing hatchery waste to land fill causes environmental problems such as releasing methane in the air and possible spread microbial contamination. It is likely that hatcheries in the future will not be permitted to dispose hatchery waste to landfill. Sustainability of these hatcheries is threatened and the challenge is to design a system that converts waste on site to valuable products which can be used on site or sold. The real challenge for the poultry industry in general is to turn all the waste into economically-valuable outputs using low-cost treatment systems. The huge volume of waste generated by the industry needs to be treated using bioprocesses to produce feed, fertiliser and fuels. These processes need to be applied to the organic waste streams (e.g., poultry manure, hatchery waste) and turn the cost of waste disposal into a source of income, recycle nutrients and reduce pollution This can be achieved by characterising and separating waste, develop products, design systems, and provide risk assessment and quality control. These approaches enable maximum conversion of carbon, nitrogen, phosphorus, and water in waste streams into biofuels and agri-products while at the same time achieving pathogen and odour control.

Composition of hatchery waste

Hatchery waste is a high protein waste with 43–71% moisture (Hamm *et al*1982). Dried hatchery waste contains 33.1% crude protein (CP), 29.0% ether extract, 12.1% crude fibre, 21.5% ash and 28.8 MJ/kg of gross energy (Sharara*et al* 1992),apparent metabolisable energy (AME) of the hatchery waste by-product meal is 23.9 MJ/kg(Sharara *et al* 1992),and the apparent amino acid availability of the hatchery waste by-product meal is 73.5% (Sharara *et al* 1993). Hence, hatchery waste could be developed into high protein feedstuffs, other value added products or utilised as an organic fertiliser after appropriate treatment.In recent years, rising disposal costs, environmental regulations and awareness have created a need for hatcheries to find sustainable alternatives for waste management.

Handling of Hatchery Waste

Dickens et al. (1976; 1978) reported on a vacuum system for handling chicken hatchery waste to reduce labor, because handling is one of the major expenses of disposal of this waste. Further research

(Dickens et al., 1978) reported on an automated system for handling this waste material. Fresh hatchery waste may contain 43% moisture (Hamm and Whitehead, 1982) or as much as 71% moisture (Vandepopuliere et al., 1992). Gladys and Smith (1973) reviewed waste disposal from 12 hatcheries. The cost of removal of the waste material averaged 84% of the total waste disposal cost. The majority of hatcheries use a vacuum extraction system to transfer the waste into bins. Some hatcheries store the waste in a cool room and then place the waste into a Bio-Bin. Other hatcheries will crush the waste first, then use a vacuum system to transfer waste into the bin. Hatchery waste can be separated into solid and liquid components and then treated separately. For example the liquid in hatchery waste can be separated from the solid hatchery waste by spinning (Philips, 1996). In addition inclined screens, followed by the use of belt or filter presses can be used for separation of solid and liquid portions of the waste. In other industries a flexible multi-layer filter can be used to separate liquid wastes from sludge wastes. The principle of this process relies on liquid waste passing through the liner into the container by gravity (Schilling et al *2011*). Another system for separating liquid and solid waste is to use a conveyor with an upper and lower conveyor roller and an endless conveyor belt extending around the conveyor rollers.

Methods to recycle egg shells

Eggs shells can be composted with other organic materials to increase the mineral content of the compost. Other minor uses for crushed egg shells include spreading around plants to deter slugs and snails, mixing with garden soil for use as a fertiliser; fine pieces of crushed egg shell mixed with seeds for use as a feed for aviary birds, adding it to cement to increase its strength, to make mosaics by artists and to make textured paint for 3D effects in artwork. These are small niche uses and not suited to industrial volumes of egg shells (Bayan 2011). Complete separation of the membrane and the shell increases the value of the resulting products. One method is to use a meat processing machine to grind egg shells into a powder, and then mix the powder with water to separate the membrane. The shell sinks and the membrane stays suspended in the water. Another method is to place the egg shells into a tank containing a fluid mixture and use cavitation (vapour bubbles in a flowing liquid) in the fluid mixture to separate the shell membrane.

Storage of Waste on Site; Bio-Bins and Skip Bins

Most of the hatchery waste is stored in dump bins before disposal to land fill or to composting sites. Some hatcheries use Bio-bins for waste storage. This is a container which enables initial composting of the hatchery waste (Biobin Technologies Pty Ltd.). Hatchery waste is placed into the Bio-bin, it is closed and made air tight and air is pumped through the bin to start the composting whilst removing odours and bacteria. The bins are also used in the chicken meat industry to compost dead birds. The composted material is used as a soil conditioner. The contents of Bio-bin are then taken to the waste sites for completion of the composting cycle. It can also be used

temporarily for hygienic storage of hatchery waste. Bio-bins have the following advantages that the collection system satisfies biosecurity requirements, odours are removed or significantly reduced and no fly and rodent contamination.

Solid Waste Treatments Systems

Power generation

The hatchery waste can be automatically fed by conveyor belts into a furnace which is equipped with a rotating shredder unit for chopping and grinding solid waste. An incinerator system can be used as a furnace to heat the solid and liquid waste to produce steam. The steam can power a turbine generator to produce electricity. The use of a steam turbine at a hatchery may only be economic if the hatchery is producing a large volume of waste.

Rendering

The rendering process simultaneously dries the material and separates the fat from the protein and yields fat and a protein meal (e.g., hatchery waste by-product meal) similar to meat and bone meal or fertiliser. There is shortage of protein meals world wide for use in diets particularly in the pig and poultry industries. The decision to render hatchery waste depends on whether it is cheaper to transport the waste to a rendering facility or to send to landfill. A major issue when using by-products such as hatchery waste meal in diets is whether they are pathogen free.

Autoclaving and extruding

Extruded or autoclaved hatchery waste could be used as livestock feed.The extrusion process reduces the moisture level of hatchery waste so it can be stored andhandled as a feed ingredient. The procedure issimple; however, equipment and energy costsmay limit its application to larger hatcheries.Integrated operations may find additional usesfor the extruder, such as processing breederdiets to control pathogens distributed throughthe feed or handling processing plant byproducts. (Miller 1983)

Boiling

Hatchery waste could be treated in the same way as poultry waste (feathers, heads, feet and inedible entrails (intestine, lung, spleen) by boiling at 100 ◦C with a pressure of 2.2 kg/cm^2 for 15 min; then boiled again at 100 ◦C for 5 hours, followed by boiling at 130 ◦C for 1 h then cooled to ambient temperature. Likewise dead embryos could be boiled for 100 ◦C for 30 min, soaked in cold water for 20 min to remove shells, sun dried for 4d and used in poultry feed . Cooking hatchery waste with water (2:1) then dehydrating to a dried product has been used as livestock feed. Nutritive value of the dried dead embryos is 36% CP, 27% ether extract, 17% ash, 10% calcium and 0.6% phosphorus.

Ensiling

Kompiang(1994) reported a method of ensiling rejected hatchery eggs. The eggs were mixed in a 1:1 ratio withformic and propionic acids for 8 weeks at room temperature. Formic acid is suitable for the ensiling of materials such as wet and protein-rich resources. Propionic acid and formic acid have been used to preserve and ensile non fertile eggs and dead embryos. The acids act by intervening specifically in the metabolism of the microorganisms involved in spoilage. In addition, the

reduction in the pH creates an environment which is unfavourable for microorganisms. The rapid reduction in the pH diminishes the growth of bacteria which produce butyric acid and ammonia and promotes the growth of lactic acid-producing bacteria. The lactic acid is responsible for the low pH necessary for storage of the by-product before being used in animal feed.

Enzyme or sodium hydroxide treatments

culled birds are treated for 12 h at 21 ◦C with 25.6 mg of (INSTAPRO)enzyme or 2 h at 21 ◦C in 0.4 N NaOH. The resulting product was fermented (with added sugar) for 21 days. After fermentation the products were autoclaved at 124 kPa and 127 ◦C for 90 min, then dried in a forced-air oven at 60 ◦C and the final product was used as poultry feed. The advantage of the enzyme or NaOH treatment is that nutrients in poultry meal are more readily digestible by birds and improve the availability of essential amino acids in the treated meal.

Composting

Composting is a common method for solid organic waste disposal (Cambardella2003). In this process, mesophilic and thermophilic micro-organisms convert biodegradable organic waste into a value added product. The decomposition of organic waste is performed by aerobic bacteria, yeasts and fungi. The composting process kills pathogens, converts ammonia nitrogen to organic nitrogen and reduces the waste volume. The product can be used as a fertiliser. Disadvantages of composting are loss of some nutrients including nitrogen, the land area required for the composting and odour problems. Das *et al* reported that composting hatchery waste with sawdust and yard trimming in a ratio of 3:2:1 or composting it with sawdust, yard trimmings and poultry litter in a ratio of 2:1:1:2 eliminated 99.99% of *E. coli*. Composting with litter also eliminated *Salmonella*, but *Salmonella* was present if temperature was too low. When hatchery waste is composted with poultry litter it will produce a safe and rich organic product which is a good organic fertiliser. It is important to control the moisture content and keep raising the temperature of the compost to eliminate the pathogens. Composting hatchery waste with poultry litter produces a product that contains 1% nitrogen, 2.5% phosphorus and 0.25% potassium on a dry weight basis. The product also contains high calcium and other micro-nutrients. A potential method for treating hatchery waste on a hatchery site is to use an 'in-vessel' composting technique.

CONCLUSIONS

- Hatchery waste can be separated into solid waste and liquid waste by centrifuging
  - Alternatively inclined screens and the use of a belt or filter press can separate the components of the waste
  - Flexible multi-layer filters can be used to separate liquid wastes from solid wastes
  - Another system for separating liquid and solid waste is to use a conveyor with an upper and lower conveyor roller. Liquid and solid wastes are separated and placed in collectors which are located near the upper and lower rollers

- Shells can be separated from the hatchery waste as follows;
  - A powerful suction vacuum is used to only remove the dry, very light shells from the hatchery waste leaving the heavier infertile eggs
  - Eggshell waste can be separated by using a vibrating or shaking device and a cyclone forced-air separator to further separate lighter materials from heavier materials in hatchery waste
  - Alternatively live chicks and unhatched chicks or clear eggs from the hatching tray are placed on a moving belt with fixed gaps that only allow chicks to slide through, while shells and unhatched eggs are retained on the belt while dead embryos are disposed into a separate container
- Methods which can be used for treating the solid waste include the following;
  - Use of a furnace to heat the waste to produce steam to run a turbine generator and produce electricity
  - Rendered, autoclaved, extruded, boiled, ensiled, enzyme treated to produce pet or livestock feed or composted to produce fertiliser
  - On site stabilisation of product by using an in-line composter.

The most effective method for treating hatchery waste on site is to establish an anaerobic digester system. It is by far the most popular process used to treat organic wastes in all other organic waste industries. It has the advantage of being a high efficiency process and produces biogas which can be used for heating or generating power. The biosolids remaining after the digester process can be used as a high quality fertiliser. Off the shelf digester systems for purchase by hatcheries are not available and need to be designed by engineers and built specifically to the requirements of each hatchery. Hatcheries disposing wastewater into lagoons could adopt the integrated aquaculture approach to produce water suitable for irrigation and other potential products such as ornamental fish; a multi-billion industry worldwide. The ideal system in a hatchery would incorporate separation and handling equipment to separate waste into its various components for further treatment. This would save disposal costs, produce biogas to reduce power costs at plants and produce a range of value added products.

REFERENCES

Bayan, R. How to recycle eggs shells. Available online: http://www.ehow.com/how_2263098_recycle-eggshells.html (accessed on 1 January 2011).

Cambardella, C.; Richard, T.; Russell, A. (2003).Compost mineralization in soil as a function of composting process conditions. *Eur. J. Soil Biol.*39, 117-127.

Das, K.C.; Minkara, M.Y.; Melear, N.D.; Tollner, E.W.(2002). Effect of poultry litter amendment on hatchery waste composting. *J. Appl. Poult. Res.11*, 282-290.

Dickens, J. A., B. C. Haynes, and W. F. Whitehead,(1978).Automated waste-handling system forlayer chicken hatcheries.USDA Leaflet ARSS-186.

Feed analyses. Pg:125-142 *In* Methods ofAnalyses. 13th ed.Dickens, J. A., B. C.

Haynes, and W. F. Whitehead,(1976).A vacuum system for handling chickenhatchery waste.USDA Leaflet ARS-S-152.

Gladys, G. E., and R. C. Smith, (1973). Waste disposalin delaware broiler hatcheries. Univ. DelawareAgric. Exp. Sta., Bull. 400.

Hamm, D.; Whitehead, W.K. Holding techniques for hatchery wastes.*Poult. Sci*. (**1982)**, *61*, 1025-1028.

Kompiang, S. Ensiling of hatchery waste using a mixture of formic and propionic acids.Sustainable Animal Production and the Environment.*In*. Proceedings of the 7th AAAP Animal Science Congress, Bali, Indonesia, 11–16 July (1994); Volume 2, pp. 179-180.

Philips, R.J. Environmental and productivity technology innovation for the food manufacturing industry. Needs statement title: Egg shells (by-products/disposal) ET-l-A-(5); R. J. Philips & Associates, Inc.: Great Falls, VA, USA, (1996).

Messer, J. 1978. Standard Plate Count. Pages 1-10 *in*FDA Bacteriological Analytical Manual. Assoc.Anal. Chem., Washington DC.Vandepopuliere, J. M., H. V. Walton, and O. J. Cotterill,(1974). Poultry egg waste: Potential feedstuffs.Pages 227-229 *In* Proc. XV World's Poult.Congr.

Miller, B.F.,(1984). Extruding hatchery waste.*Poult. Sci.*63, 1284-1286.

Sharara, H.H.; El-Hammady, H.Y.; El-Fattah, H.A.(1993).Nutritive value of some non-conventional by-products as poultry feed ingredients. 1. Chemical composition. *Assiut J. Agric. Sci.23*, 333-349.

Sharara, H.H.; El-Hammady, H.Y.; El-Fattah, H.A.(1992). Nutritive value of some non-conventional by-products as poultry feed ingredients. 2. Biological determination of metabolizable energy. *Assiut J. Agric. Sci.*, *23*, 349-363.

Sharara, H.H.; El-Hammady, H.Y.; Abdel-Fattah, H.(1993). The nutritive value of some non-conventional by-products as poultry feed ingredients. III. Apparent and true availability of amino acids. *Assiut J. Agric. Sci.*, *24*, 311-323

Vandepopuliere, J. M., L. A. Voss, and H. B. Jones,(1977).The potential of hatchery waste as a feedingredient.Missouri Agric. Exp. Sta. SR200.

Wisman, E. L.,(1964). Processed hatchery by-productas an ingredient in poultry rations.*Poultry Sci.* 53:871-875.

Wisraan, E. L., and W. L. Beane, (1965).Utilization ofhatchery by-product meal by the laying hen.*Poultry Sci*. 54:1332-1333.

Algae: A Rich Source Of Biologically Active Secondary Metabolites

Kavita B. Joshi*[1] and Viral P. Joshi*[2]

[1]Ph.D. Scholar, Department Of Biochemistry, Collage of Agriculture,
[2]Ph.D Scholar, Department of Renewable Energy and Rural Engineering, CEAT,
Junagadh Agricultural University, Junagadh (362001), Gujarat
*Corresponding author email: kjoshi2804@gmail.com

Abstract

Algae are a rich and varied source of pharmacologically active natural products and nutraceuticals. Algae are rich in dietary fiber, minerals, lipids, proteins, omega-3 fatty acids, essential amino acids, polysaccharides, vitamins A, B, C, E and carotenoids, phycobilins, sterols, and biologically active molecules for use in human and animal health. This bioactive ingredients of algae have revealed numerous health-promoting effects, including anti-oxidative, anti-inflammatory, antimicrobial, and anti-cancer effects. The antioxidative effects and bioactivities of several different crude extracts of algae have been evaluated both in vitro and in vivo. Natural products derived from algae protect cells by modulating the effects of oxidative stress. Because oxidative stress plays important roles in inflammatory reactions and in carcinogenesis, algal natural products have potential for use in anti-cancer and anti-inflammatory drugs. Use of algae, for antibiotics and pharmacologically active compounds has received ever increasing interest.

INTRODUCTION

Algae are one of the primary producers it is the divisions of lower plants that contains chlorophyll in plant cells. They can be divided broadly into macro- algae (macroscopic algae) and microalgae (microscopic algae). The wide diversity in the biochemical composition of algae provides an excellent choice to explore a variety of biologically active components in their bodily composition with a broad range of physiological and biochemical characteristics, many of which are rare or absent in other taxonomic groups. Compared to the terrestrial plants and animal-based foods, algae is rich in some health-promoting molecules and materials such as, dietary fiber, ω-3 fatty acids, essential amino acids, and vitamins A, B, C, and E. The majority of the investigations on the metabolites derived from algae species have revealed their potential antioxidant, anti-inflammatory, antidiabetic, antitumor, antihypertensive, and anti-allergic properties, as well as their role in hyaluronidase enzyme inhibition, neuroprotection, bone-related diseases and in matrix metalloproteinase (MMPs)

inhibition activity (Fig: 1). Bioactive substances derived from algae have diverse functional roles as a secondary metabolite, and these properties can be applied to the development of pharmaceutically important products. Well-documented bioactive metabolites of algae include brominated phenols, brominated oxygen heterocyclics, nitrogen heterocyclics, kainic acids, guanidine derivatives, phenazine derivatives, amino acids and amines, sterols, sulfated polysaccharides, prostaglandins and many more. However, not all species of algae have health-promoting properties, as some areknown to produce toxic metabolites that cause neurodegenerative disorders.

Fig1.: Health benefits of algae.

ANTIOXIDANT PROPERTY OF ALGAE

Antioxidants play prominent role in the later stages of cancer development. The most powerful water soluble antioxidants found in algae are polyphenols, phycobiliproteins and vitamins. Oxidative processes promote carcinogenesis. The antioxidants may be able to cause the regression of premalignant lesions and inhibit their development into cancer. It is found that , several algal species have prevented oxidative damage by scavenging free radicals and active oxygen and hence able to prevent the occurrence of cancer cell formation, these Antioxidants are considered key compounds to fight against various diseases (e.g. cancer, chronic inflammation, atherosclerosis and cardiovascular disorder) and ageing processes. For example, ethanol extracts of *C. japonica* suppressed H_2O_2-induced cellular apoptosis and activated cellular antioxidant enzymes. Free-radical-scavenging assays using green algae revealed antioxidant properties for the sesquiterpenoids from *Ulva fasciata Delile.*

ANTIMICROBIAL PROPERTIES OF ALGAE

Algae exhibit antimicrobial activity which finds use in various pharmaceutical industries. Ochromonas sp., Prymnesiumand a number of blue green algae produce toxins that may have potential pharmaceutical applications. Various strains of cyanobacteria are known to produce intracellular and extracellular metabolites with diverse biological activities such as antibacterial, antifungal and antiviral activity. The biological activities of the algae may be attributed to the presence of volatile compounds, some phenols, free fatty acids and their oxidized derivatives.

ANTICANCER PROPERTY OF ALGAE

Algae produce variety of chemically active metabolites in their surroundings as a weapon to protect themselves against

other settling organisms. The extensive biological activities mentioned for algae include the transcendent anticancer and antitumor effect of secondary metabolites isolated from various species of algae. Activation of the intrinsic and extrinsic pathway of apoptosis, increase in the immune response, suppression of angiogenesis, and reduction
in the adhesion of tumor cells to human platelets are suggested as mechanisms responsible for significant antitumor activity of metabolites(Table-1). The superiority of antitumor strength shown by oversulfated fucoidan found in brown algae. Carotenoid and to more extent its metabolite, fucoxanthinol, demonstrated noteworthy antitumor activity associated with the free radical scavenging potential, induction of apoptosis, and the anti-angiogenic effect.

CONCLUSION

Algae is obliged as significant sources of natural bioactive substances and there has now emerged a new proclivity towards isolating and identifying such compounds and constituents from algae. It can be concluded from previous studies on algae bioactivity that microalgae is probable to develop antimicrobial, antioxidant and anticancer drug as it is a product of nature. However, further studies need to be performed to fully exploit its anticancer properties such as determination of the nature of cell death caused by the extract or visual detection and confirmation of apoptosis. From this review we conclude that Marine algae are known to produce a wide variety of bioactive secondary metabolites and several compounds have been derived from them for prospective development of novel drugs by the pharmaceutical industries.

REFERANCES

H. Yang,M.Zeng, S. Dong,Z. Liu, and R. Li, "Anti-proliferative activity of phlorotannin extracts from brown algae Laminaria japonica Aresch," *Chinese Journal of Oceanology and Limnology*, vol. 28, no. 1, pp. 122–130, 2010.

R. Pangestuti and S. K. Kim, "Biological activities and health benefit effects of natural pigments derived from marine algae," *Journal of Functional Foods*, vol. 3, no. 4, pp. 255–266, 2011.

A. M. S. Mayer and K. R. Gustafson, "Marine pharmacology in 2000: antitumor and cytotoxic compounds," *International Journal of Cancer*, vol. 105, no. 3, pp. 291–299, 2003.

Seenivasan, R., Indu, H., Archana, G., Geetha, S., 2010. The antibacterial activity of some marine algae from South East coast of India. Am. Eurasian J. Agric. Environ. Sci. 9 (5), 480–489.

El-Naggar, M.E.E., 1987. Antimicrobial activity of some marine algae of Egypt. Mansoura Sci. Bull. 14 (2), 189–201.

Chu, W. L. (2011). Potential applications of antioxidant compounds derived from algae. Current Topics in Nutraceutical Research, 9, 83–98

Tierney, M. S., Croft, A. K., & Hayes, M. (2010). A review of antihypertensive and antioxidant activities in macroalgae. Botanica Marina, 53, 387–408.

Table 1: Anticancer and antitumor activity of secondary metabolites isolated from algae.

Source of isolation	Type of activity and possible mechanisms
S. thunbergii	Growth inhibitory activity in Ehrlich ascites carcinoma in mice
S. thunbergii	Antitumor effect in mice with Ehrlich carcinoma transplanted
A. nodosum	*In vivo* and *in vitro* inhibitory effect against NSCLC-N6, non-small-cell human bronchopulmonary carcinoma
U. pinnatifida	Antitumor effect against P-388 tumor-bearing mice
F. vesiculosus	Elevation of antiangiogenic and antitumor activities by oversulfation
C. novae-caledoniae Kylin	Anti-angiogenic activity on human uterine carcinoma HeLa cells
F. vesiculosus	Induction of apoptosis in human lymphoma HS-Sultan cell line associated with caspase-3 activation and downregulation of ERK pathway
C. okamuranus	Growth inhibitory activity on stomach cancer cell line of MKN45
F. evanescens	Enhancement in etoposide induced caspase-dependent cell death pathway on MT-4, human malignant lymphoid cell lines
F. evanescens	Antimetastatic and antitumor activity in C57Bl/6 mice with transplanted Lewis lung adenocarcinoma
L. saccharina, *L. digitata*, *F. vesiculosus*, *F. serratus*, *F. distichus*, *F. evanescens*, and *A. nodosum*	Blocked adhesion of MDA-MB-231 breast carcinoma cell to platelets
C. okamuranus	Induction of apoptosis in U937, human leukemia cells, by oversulfated form of fucoidan
C. okamuranus	Induction of apoptosis in MCF-7 cells, human breast cancer, via caspase-8-dependent pathway
F. vesiculosus	Induction of apoptosis in HCT-15, colon carcinoma cells
F. vesiculosus	Induction of apoptosis in HT-29 and HCT116, human colon cancer cells, via both intrinsic and extrinsic pathways
U. pinnatifida	Antitumor activity against PC-3, HepG2, A549, and HeLa cancer cells

Biological Molecular Motors

Kavita B. Joshi

Research Scholar, Department of Biochemistry, JAU, Junagadh
Corresponding author e-mail id:kjoshi2804@gmail.com

Definition: - "A **molecular motor** has been defined as a discrete number of molecular components that have been designed to perform mechanical-like movements (output) in response to specific stimuli (input)."

Molecular motors can be divided into two broad categories:

Biological Molecular motors:-Biological molecular motors are a natural way to done all the work and billions of years of evolution has made this motors a state of-the-art machines. They are small, efficient and highly adapted to their role*. i.e* Most complex molecular motor is biological motor – cell.

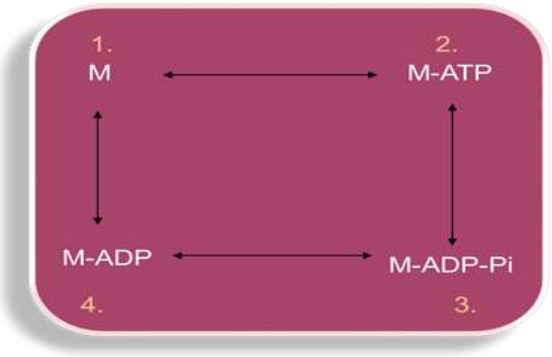
SyntheticMolecular motors:-As Traditional (Electric) Motor convert electrical energy in to mechanical motion, same way Biological Molecular Motor convert chemical energy in to mechanical motion.

It is a class of protein in cell controlling complex biological dynamics processes in a **fast and effective way.***i.e*. nanorobots attacking *Staphylococcus aureus* bacteria.

Basic principles of molecular motors

Basically motor proteins are molecules which use the energy gained from cyclical ATP hydrolysis to move along cytoskeletal filaments which constitute the backbone of the cell. A motor generally attaches itself to a certain spot on the filament, hydrolyses an ATP molecule and moves one »step« along the filament.

After this it can either disconnect (linear motor proteins) or stay connected and repeat many steps (processivem.p.). It is also interesting to note that a motor protein can only move along the filament in one direction. Different proteins can move in different directions.



First, motor proteins are ATPase- they bind, hydrolyze ATP and then release the products sequentlially. And during these transitions, protein conformational changes occur that produce motility.

Tools of molecular motors:-

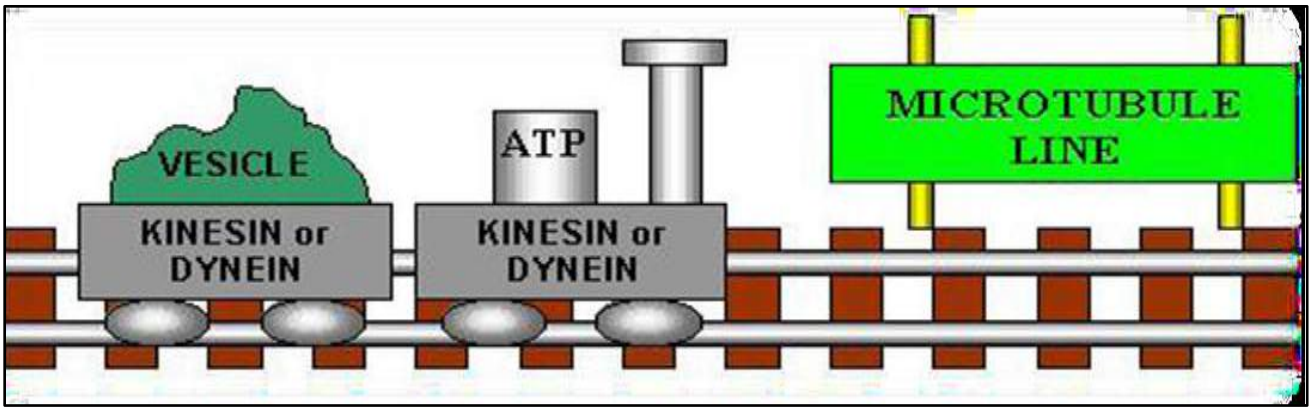
Tracks – cytoskeletal filaments

- Actin
- Microtubules

Direction – only polarized filaments form tracks

Converter – a motor protein to change cellular energy into force

Fuel - ATP



Applications

1. Nanomedicine

Disease and ill 1health are caused largely by damage at the molecular and cellular level.In the future, fleets of surgical tools that are molecular both in size and precision.

We will also have computers much smaller than a single cell to guide those tools.

2. Remove infections
3. Clear obstructions
4. Reciprocates
5. Release and absorb
    - ATP, other metabolites
    - Na^+, K^+, Cl^-, Ca^{++}, other ions
    - Neurotransmitters, hormones, signaling molecules
    - Antibodies, immune system modulators Medications *etc*.
6. Correcting DNA
7. Nanomachines in biology

Nanoscale machines already exist in biology, *i.e.* Functional molecular components of cells.They exist in enormous variety and sophistication

- Biochemical motors
- Ribosomes make proteins in an assembly-line like (sequential) process
- Topoisomerase unwinds double-stranded DNA when it becomes too tightly bound

REFERENCES

Bruce A, Dennis B, Karen H, Alexander J, Julion L, Martin R, Keith R and Peter W. (2010). *Essential Cell Biology*. Garland Science. New York and London, 2nd*ed*, 571 – 607.

Primož D. (2006). Molecular motors-the miracle of motion, http://mafija.fmf.uni-lj.si/.

Reddy AS. (2001). Molecular motors and their functions in plants.*International Review of Cytology*, 204:97-178.

Ultrasonography:

Used As A Tool For Pregnancy Diagnosis In Bovine

Balamurugan B, Rahul Katiyar, Nitish Singh Kharayat, G.R.Chaudhary,
Maulik Patel and G.K. Mishra

PhD Scholars
Division of Animal Reproduction, Indian Veterinary Research Institute,
Izatnagar, UP – 243 122

Definition

Ultrasonography is study of internal organs or blood vessel using high frequency sound waves, the actual test called ultrasound scan or sonogram. Ultrasound waves are sound waves of frequencies greater than audible to human ear i.e. greater than 20,000Hz. Frequencies between 1 to 10 MHz are mainly used for the purpose of diagnostic ultrasound.

History

In 1876 Sir Francis Galton done 1st ultrasound instrument developed in dog.In1880 Jacques & Pierre - discovery of piezoelectric effect (mechanical electric).In 1940 -Ultrasonic energy was 1st applied in human body for medical purpose. In 1970 – Real time ultrasound in humans and A- mode & Doppler for pregnancy diagnosis in Animals. In 1980 – Real time ultrasound imaging in Animals.

Applications

Pregnancy diagnosis, Monitoring fetal development, Fetal viability, Estimating the gestational age, predicting parturition, Fetal sex determination, diagnosis of various reproductive tract diseases and Supplementing breeding soundness examination.

Principle

A sound waves travels in a pulse & when it is reflected back it becomes an echo. The pulse-echo principle is used for ultrasound imaging. Equipment consists of transducer & scan converter. The transducer/probe piezoelectric crystals by high electric current expand or contracts & emits high frequency ultrasound, Returning echos reflected back to transducer, compress the crystals, result in electric impulses. Scan convertor interprets based on brightness or amplitude & stores image.

Different type Modes of ultrasonography:

A Mode (Amplitude depth analyser): one dimension display of echo amplitude for various depths. Used to detect pregnancy as early as 40 days.

Doppler(Ultrasonic fetal pulse detector) : Detection of movements as an indication of pregnancy such as fetal heart beat, fetal circulation and fetal movements. Detection of pregnancy

earlier in gestation than the A-scan technique. Fetal viability can be detected but accurate detection of multiple fetuses is difficult. 85-95% accuracy in positively identifying pregnancy

B Mode (Brightness modality)

called as Real time USG .Two dimensional display of dots on screen. Brightness propotional to the amplitude of returning echos. This is the most accurate, rapid, safe and early diagnosing pregnancy.Used to distinguish a pregnancy from hydrometra, pyometra and fetal mummification.

M Mode (Motion mode)

updated B mode for evaluation of moving structures such as heart

Transducers

Three types**:** Linear array, Sector, Convex type.

In Linear array crystals arranged side by side in lines and 2D image of rectangle in shape.Used for mainly transrectal having frequiencies 5-10MHZ and suited for sections parallel to longitudinal axis.In Sector type single crystal rotates or oscillates to produce pie/fan shaped image. Mainly transabdominally used and have frequiencies 1-4MHZ. Give transverse views.Curved array is a modified linear array with curved surface.

7.5MHZ for early, as early as 9 days (Boyd et al) & 3-5 MHZ for late pregnancies.Most appropriate time for pregnancy diagnosis using translinear rectal probe with high accuracy is on day 28-30(5-7.5MHZ).By day 40,100% accuracy & day 25 ,94-95% accuracy (Hanzen and Delsaux,1987) .3.5MHZ transcutaneous sector probe for pregnancy diagnosis in cattle b/w 70-190 day. High frequency ,good detail & vice versa

Technique of Transrectal sonography with linear transducer

Similar to that of the rectal palpation. Evacuate rectum and palpate the internal genitalia in usual manner. Transducer is covered with a plastic sleeve with coupling media/gel put inside. Hand held ultrasound probe is introduced through the anus and then advanced cranially along the rectal floor. Uterine horn on side is scanned to entire length, ovary is examined for presence of CL & move hand to next uterine horn,ovary. Advanced cases operator moves his hands deeper. Tentative diagnosis of early pregnancy can made on identification of a non-echogenic area within the lumen of uterine horn due to fetal fluids.Definitive diagnosis dependent on the identification of embryo or fetus. Fluids will appear as black: Non-echogenic, Hard tissues like bone appear as White: Echogenic and Structures midway b/w bone & fluids appear as Grey: Hypoechoic .

Early Pregnancy Diagnosis

Detection of the embryo proper as well embryonic and fetal developmental characteristics during early fetal development are shown in table. The bovine fetus can be visualized beginning at 20 d post breeding and continuing throughout gestation, however, because of its size in relation to the image field of view, the fetus cannot be imaged in to after about 90 days using a 5.0 MHz linear-array transducer.

Table 1: Day of first detection of ultrasonographically identifiable characteristics of the bovine conceptus

	First day detected	
Characteristic	**Mean**	**Range**
Embryo proper	20.3	19 to 24
Heart beat	20.9	19 to 24
Allantois	23.2	22 to 25
Spinal cord	29.1	26 to 33
Forelimbs buds	29.1	28 to 31
Amnion	29.5	28 to 33
Eye orbit	30.2	29 to 33
Hind limbs buds	31.5	30 to 33
Placentomes	35.2	33 to 38
Split hooves	44.6	42 to 49
Fetal movement	44.8	42 to 50
Ribs	52.8	51 to 55

Estimation of gestational age

By determining Heart frequency, crown-rump-Iength, diameters of stomach, trunk, scrotum and umbilical cord. The movements of the heart can first be seen very early at the end of the first month of pregnancy. The heartbeat of young fetuses is very high occasionally reaching a value of 180 to 204 beats per minute during the third month of pregnancy .The mean heart rate decreases as pregnancy progresses and lies around 160 beats per minute at Day 60. 150 around Day 90 and 130 to 140 between the fifth and ninth months of pregnancy. The crown-rump-Iength (CRL) of bovine fetuses is only being determined over a relatively short period. Due to the limited size of the image of most ultrasound scanners, it is hardly ever possible to still depict fetuses in toto once they have reached a length of more than 10 cm.The CRL (measured between the occipital bone and the first vertebra of the tail) reaches 12 mm onwards the end of the third month of pregnancy . The daily increase in CRL is about 1.4 mm at the beginning of the second month and increases to 2.5 to 3 mm during the third month. The determination of the CRL is one of the most accurate of deciding on the age of a fetus.

The anechoic lumen of the stomach become reliably recognizcd and surveyed towards the end of the second month of pregnancy . The scrotum can also be evaluated fetometrically. From Day 60 it forms an echoic structure which projects from the abdominal wall. The scrotal width can be determined on a transverse sect ion through the pelvic region.

Sex determination in the bovine fetus

Scrotum, teats and genital tubercle

At approximately day 50 of gestation, male and female fetuses can be differentiated by the relative location of the genital tubercle and development of the genital swellings into the scrotum in male fetuses. Fetuses at 48 to 119 days of age have been successfully sexed. The procedure is reliable and accuracy has ranged from 92 to 100%.For optimal results the ultrasound transducer should be manipulated to produce a frontal, cross-sectional, or sagittal image of the ventral body surface of the fetus. In larger framed cows (i.e. Holsteins and Continental beef breeds) or older cows the optimum window for fetal sexing usually is between day 55 and 70 of gestation, whereas for smaller framed cows (Jerseys and English beef breeds) the ideal

window usually is between day 55 and 80 of gestation. There are two limitations that could inhibit the ability of a technician to determine the sex of a fetus: 1) as the fetus increases in size it becomes more difficult to move the transducer relative to the fetus to obtain the desired image; and, 2) the gravid horn is more likely to descend ventrally into the abdominal cavity in larger or older cows, making fetal sexing virtually impossible without retracting the gravid horn.

Estimation of Fetal Numbers

Twin or multiple pregnancy can be find out. The accuracy of detecting absolute fetal numbers is poor. Generally, the numbers of fetuses are underestimated. Fetal resorption may also produce a disparity between the number of conceptuses imaged and the number of offspring born.

False negative diagnoses produced by overlooking a conceptus, or due to acoustic artifacts produced by gas or faecal material hiding a conceptus.

False positive diagnoses may be the result of the confusion of empty loops of small intestine with early pregnancy. Resorption of fetus may be missed if the initial ultrasound exam is delayed,and inaccurately reported as a failure to conceive.

CONCLUSION

Ultrasonogaphy can be successfully applied for research purposes to study early pregnancy and fetal sexing. With repetitive training and a certain degree of skill, technicians are now able to offer services that will enhance profitability of many cattle operations.

Magnetic Refrigeration: A Novel Technology

Rashmi Bhardwaj[1], Diwakar Mishra[1] and Simran Arora[2]

[1]Dairy Technology Division, ICAR- National Dairy Research Institute, Karnal, Haryana.
[2] Centre of food science and technology, CCSHAU, Hisar, Haryana.

Refrigeration is the process of removal of heat from an enclosed volume or substance to lower the temperature and maintain it. Magnetic refrigeration exploits the magnetic properties of certain solid materials to produce refrigeration.Magnetic refrigeration involves magnetic material (refrigeration media) and magnetic field. Magnetic refrigeration is a method of refrigeration based on the magnetocaloric effect (MCE). Magnetocaloric effect is a phenomenon in which a reversible change in temperature of a magnetic material is caused by exposing the material to changing magnetic field.

History

Magnetocaloric Effect was first discovered in pure iron in 1881 by E. Warburg. In late 1920s, cooling via adiabatic demagnetization was first independently proposed by Debye (1926) and Giauque (1927).This cooling technology was first demonstrated experimentally by chemist Giauque and his colleague in 1933 for cryogenic purposes. In 1997, the first near room temperature magnetic refrigerator was demonstrated by Prof. Karl A. Gschneidner.

Principle of magnetic refrigeration

MCE is the basic principle on which cooling is achieved. The Magnetic materialis subjected to a magnetic field which causes alignment of magnetic moment. This alignment of magnetic moment results indecrease of entropy and an increased temperature of the magnetic material. Removal of magnetic field results in re orientation of magnetic moment, increase of magnetic entropy and thus decrease in temperature. Key components of magnetic refrigeration system are magnetic field sources and magnetocaloric materials.

Magnetic field sources

Efficiency of magnetic refrigerator directly related to magnetic field as it generates entropy change in magnetocaloric refrigerant. Higher the external field, higher is the entropy change and thus higher temperature change. Therefore, superconducting magnets are required for industrial use and permanent magnets can serve domestic applications.

Commonly used magnetic materials

Gadolinium (have high price, poor resistance to corrosion and oxidation). $Gd_5Ge_2Si_2$ and its derivatives (have giant magnetocaloric effect, two times larger entropy variation compared to Gd). $MnFeP_{1-X}As_X$, $MnAs_{1-X}Sb_X$, MnAs and $LaFe_{13-X}Si_X$ (results in large change of magnetic entropy, giant magnetocaloric effect, reduced thermal hysteresis).

Steps of thermodyanamic cycle

There are four steps involved in the thermodyanamic cycle of magnetic refrigeration: Adiabatic magnetization, Isomagneticenthalpic transfer, adiabatic demagnetization, Isomagnetic entropic transfer.

Adiabatic magnetization: The increasing external magnetic field causes the magnetic dipoles of the atoms to align. The net result is that the item heats up.

Isomagnetic Enthalpic Transfer: This added heat can then be removed by fluid like water or helium. The magnetic field is held constant to prevent the dipoles from reabsorbing the heat.

Adiabatic demagnetization: The substance is returned to another adiabatic condition so the total entropy remains constant. Thermal energy causes the domains to overcome the field and thus the sample cools.

Isomagnetic Entropic Transfer: The magnetic field is held constant to prevent the material from heating up back. The material is placed in thermal contact with the environment being refrigerated.

Criteria for selecting a magnetic refrigerant

The magnetic refrigerant should have a large MCE, large density of magnetic entropy, small lattice entropy, nearly zero magnetic hysteresis, very small thermal hysteresis, small specific heat and large thermal conductivity, large electric resistance

Advantages

- Green technology (no use of conventional refrigerants)
- Noise-less technology (no compressor)
- Very high thermodynamic efficiency (20-30% higher than in conventional cycles)
- Lower energy consumption
- Simple construction
- Low maintenance costs
- Low pressures requirements

Disadvantages

- Strong magnetic fields with not completely known influences on living creatures
- Protections to avoid disturbances of electronic components
- The field strengths of permanent magnets are still limited, superconducting magnets are too expensive

Future Applications

- Cooling plant in the food and dairy industry
- Large marine freezing applications
- Magnetic household refrigeration appliances
- Supermarket refrigeration applications
- Central cooling system and Room air conditioners

CONCLUSION

Magnetic refrigeration is a promising technology for energy saving and environment benefits. This enabling technology will firmly replace the CGC technology in the near future. The materials with the superior magnetocaloric properties in addition to cheap materials will be the option of future magnetic refrigeration technology.

Resource Conservation Technologies: Need of Today's Agriculture

Gaurav*[1], S Bahadur[2], S K Verma[3], V K Verma[4], Abhinav Kumar[5] and Arvind Kumar[6]

[1,2,4,5,6] Research Scholar, [3]Assistant Professor Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi - 221005
**Corresponding author Email: gauraviasbhu@gmail.com*

Resource conserving technologies (RCTs) can be defined as any method, tool or machine which improves the input use efficiency, enhances crop productivity and increase the farm gate income of the farmers, which includes: A. *Crop establishment methods*, i.e. tillage system: zero tillage and reduced/minimum tillage, bed planting, mechanical rice transplanting, drum seeding and . B. *Water management*: laser aided land levelling, C. *Nutrient management*: - leaf colour chart (LCC), 2. Use of chlorophyll meter (SPAD) . Out of these, zero/minimum tillage is considered as the major RCT, which has the tremendous scope for reducing the energy requirement and does not have adverse impact on succeeding crops. Currently these technologies, i.e. zero till-seed cum ferti drill is being adopted in about 2.0 mha area during *rabi* season in wheat in India and resulted in saving of precious energy, ease of intercultural operations, timeliness of planting, reducing the cost of cultivation, conserve the resources by its most efficient utilization, enhances the crop productivity and farmer's income.

RESOURCE CONSERVING TECHNOLOGIES

Any method, tool or machine which improves the input use efficiency, enhances crop productivity and increase the farm g ate income of the farmers is called Resource Conserving Technologies (RCT's). There are number of technologies developed in different countries and spread to other parts of the world. These have been tested, and refined as per the local needs. Some of them are discussed here.

Crop establishment methods:-

Zero tillage systems

This concept was introduced in early seventies because of the worst ever oil crisis at that time. This is a crop planting system that entails no preparatory tillage (ploughing, harrowing etc.) and there is slight soil disturbance associated with creating a narrow slit for placing seed (and in some cases fertilizer). The zero-till seed drill reduces tillage to only one pass against the normal practice of 4-1 passes. No-till or direct drilling has enormous potential to contribute to sustain and cost effective food production worldwide. This ensures timely planting leading to 1-4 weeks early sowing, saves energy, fuel saving by 60 L ha^{-1}, and

water (20-30%) especially in first irrigation due to smooth surface, requires less seed rate, labour and time, less crop lodging , better fertilizer-use efficiency and soil aeration, uniform seed germination, reduces weed pressure, better plant stand, improved soil fertility due to decomposition of stubbles of previous crops, improves fertilizer nutrient use efficiency, weakness density of *Phalaris minor* (40% reduction) reduced soil erosion and compaction, lesser herbicide use, better residual soil moisture use, reduces wear and tear of tractor, helps in reducing air pollution, improved environmental indicators, lesser CO_2 emission and reduced global warming, more rodents population, increases farmers profit by Rs 2,200-3,000/ha, cost of production is reduced by Rs 8,000/ha, increased yield by 10-17%, increases water infiltration, soil organic matter and soil organisms, more flexibility-less dependence on weather conditions and save material cost. In undisturbed condition, water flows over the soil surface quicker and so a light irrigation can be applied in zero-tilled fields and it saves water to the tune of 10-12 cm/ha or 1.0 million L/ha. This system has led to reduced weed population pressure in the short term. This requires 3-4% more soil moisture content in wheat at sowing time but fuel consumption is only 10-12 l/ha.

Surface seeding

Excessive moisture in soils are a major problem in low lying lands of the rice-wheat system of IGP which is due to heavy rains ; lowland ecologies, residual moisture from the last crop and poor drainage systems. This results in very late planting or no planting leading to fallow lands. Such lands can be brought under cultivation by surface seeding. It is the simplest true zero tillage system. Seed of various crops like lathyrus, wheat, lentil, peas, linseed and mustard is broadcast on a saturated or wet soil surface without any land preparation and in the presence of crop residues on or before crop harvest. This was practiced by farmers in many parts of the Eastern Uttar Pradesh. It does not require any tractor or animal power or seeding mechanisms for its adoption. It is suitable for the areas with fine textures soils and poor drainage or where land preparation is difficult and often results in a cloddy tilth. In this system, tillage is completely eliminated. If soil moisture is less than optimal, first broadcast the seed and then apply irrigation to improve soil wetness to enhance seed germination and facilitate root penetration. If the moisture is very high, it leads to the rotting of seeds and if very low, it may lead to poor germination. This method is simple and leads to timely sowing of the crop. Surface seeding of wheat has also proven to be most effective for cropping on extensively wet soils, it saves labour, fuel and requires no machinery, reduces tillage and cost or production. This is mainly practiced in eastern India, Bangladesh and Nepal. Bhairahwa in Nepal is the lead center for such studies.

Reduced tillage systems

This is a compromise between conventional and zero till systems. If excessive weed problems, reduced tillage options may be favoured rather than zero-

till. In reduced tillage e, there is only one or two sloughing before seeding. It reduces costs due to saving in fuel and labour, leads to timely planting of *kharif* and *rabi* crops and improved plant stand, lowers density of *Phalaris minor*, water saving up to 15-20%, improved input use efficiency (seed, fertilizer nutrients) and results in higher yield. There are two types of machines developed in China and spread to Pakistan and India, viz. Chinese till drill – this was developed for rice and wheat. It rotates the soil at a shallow depth, ahead of a six row fluted roller planter. This is followed up by a roller to compress the soil and get good seed-soil contact. It allows the farmers to compress the soil and get good seed-soil contact. It allows the farmers to plant wheat immediately after rice harvest. The seed is placed in the rotovated soil and all operations are in one go-rotovator and seeding.

Bed planting

In this system, furrow irrigated raised bed planting (FIRB) systems, crops are grown on raised beds and furrows are grown on raised beds and furrows are used for irrigation. It is a technology that ca n be used in rainfed or irrigated situations, and may be more useful in rice-wheat systems in low-lying, poorly drained soils where land preparation is problematic. This is also suitable for partially reclaimed alkali soils because this leads to double rooting depth which permits healthy growth of crops. For this technology, CIMMYT and ICRISAT Hydrabad, are the international lead centers for Mexico and India, respectively. In India, PAU, Ludhiana and GBPUA&T, Pantnagar for tractor powered areas and Bhairhawa in Nepal and Bihar in India are lead centres for animal powered sector. The intercrop (e.g. mint, pea, linseed, mustard, wheat with sugarcane, and winter maize with potato, onion, garlic, maize and sugarcane, maize or sugarcane with wheat) can be planted on the sill of the furrows, with the main crop planted on the ridges. This provides an opportunity for crop intensification along with substantial saving of 25-50% compared to conventional practice and when rice is planted in two rows on bed, there was saving of 30-50 cm of water. This increases the use efficiency of water and fertilizers, reduces lodging and improves pest and weed control with reduced use of external inputs, fewer weeds (*Phalaris minor*), better plant stand and more vigorous, lower seeding rates (30-50%), less dredging (30-40%), improved water and fertilizer use efficiency, convenient weeding and fertilizer application, better soil aeration, better drainage results in less water logging and crop damage, improved rain water conservation and crop productivity. The beds can be of two types: (a) seasonal which are to be made a fresh in each season (b) permanent – which are to be reshaped (only minor repair) after each seasons for planting the next crop. There is reduction of 20% in cost and it is more suitable system. The size of furrows and beds varies with crops. There is no saving in cost of land preparation or time. Permanent raised bed planting system is a more suitable system and as it offers scope for diversification and intensification of the cropping system in the IGP even during the monsoon season. These machines for

Indian conditions were modified by Pantnagar and Ludhiana.

Mechanical rice transplanter

It was developed by Japan, Korea and China, but Chinese transplanters are 10 times cheaper than others. For this machine, specialized mat seedlings of rice of fixed size are raised in iron frames which are used for transplanting. The planting is done very fast and labour cost is reduced drastically, but there are some gaps which are to be filled manually afterwards.

Parachute planting of rice

This methodology was developed in China for rice planting due to mounting pressure of scarce skilled labourers during rice planting. In this, rice seedlings are grown on bubble plastic sheets on beds. After puddling, the seedlings are broadcasted either manually or by mechanical blower. There is no transplanting shock or seedling mortality at the early stage and optimum plant density can be achieved.

Drum seeding

In this system, field in puddle and then sprouted seeds are placed on the wet soil by broadcasting the seeds or by using a drum seeder and is more popular in Asia, as it reduces labour cost and more eco-friendly. This reduces the costs of production, fuel use, allow early planting, reduces weed growth and avoid rice fallows. These are of two types, i.e. surface or aerobic – in this, pre-germinated seeds are sown one or two days after puddling on the surface of well puddle soil. There is uniform broadcasting of seeds either by hand or by a motorized sprayer or drum seeder for line sowing. In this, the seed is only half buried in the soil. For drum seeding, 100-150 kg seed/ha is needed and in sub-surface or anaerobic – in this, pre-germinated seeds are broadcasted after puddling and allowing a thin layer of mud to settle on them or pre-germinated seeds can be placed in rows one or two days after puddling by an aerobic seeder fitted with furrow openers and closer. The seeds are provided a protective cover against damage by weather conditions or pests.

Shrub master

After mechanical rice harvest, it cuts the remaining stubbles of 20-40 cm height into small pieces which can be used as fodder or can be incorporated in the soil.

Water management

Laser aided land leveler

It was developed by IRRI, Philippines and spread to Pakistan and India which very precisely levels the land ($\pm$2 cm). This improves water use efficiency (WUE) through uniformity in water application, better crop stand, improved nutrient-water interactions, combined with bed planting and zero tillage etc . Will help improve WUE and save irrigation water up to 20-25%, increases available planting area by 2-7%, curtails irrigation application losses (25%), reduces labour requirement for irrigation (35%), and promotes the adoption of improved soil and crop management practices and increase crop yields (20-24%). This is becoming very popular among the farmers of north-west IGP region and there is huge demand of this machine. Some of the farmers have commercialized this technology and getting huge business and benefit.

Nutrient management

Leaf colour chart

In ca se of nitrogen (N), site-specific management technique through leaf colour chart (LCC) which is inexpensive, simple and useful in determining right time and dose of N side dressing, and is helpful in avoiding excess use of N. With this technique, leaf nitrogen content can be estimated at specific stages of plant growth by comparing leaf greenness with a colour chart. In this way, it gives farmers an idea as when to apply fertilizers and how much is needed. Even small farmers can afford the equipment. Judicious and need based use of fertilizer with LCC will enhance productivity, reduce cost and minimize ground water contaminations and pollution. Based on IRRI's results, LCC have been developed to help farmer's select right dose and time of application for optimum response. Its cost is very nominal, i.e. <10$ per piece and a non-destructive method for assessing N requirements of plants. It is an ideal tool to optimize N use, irrespective of the source of N-organic, biological or chemical fertilizers. It has 6 colour shades-yellowish green-1, dark green-6 and holder in grey colour. In rice, observations are started on 14 days after transplanting or 21 days after sowing and the last reading is taken at flowering. It is measured in shade of your body. Ten leaves are selected and readings are taken at 7-10 days interval (early tillering, active tillering, panicle initiation, and first flowering). On appearance of deficiency symptoms, about 20-30 kg N/ha is applied for wet season or low-yielding season and 30-35 kg/ha for dry season or high yielding season at each stage. It results in savings of 8-22 kg/ha, and yield increase of about 2-8%. More than 4.0 lakh farmers a\use the LCC for real time N management in rice in different Asian countries (Bangladesh – 1,000, India – 10,000, Vietnam – 3.0 lakh).

Use of chlorophyll meter (SPAD)

It is a non-destructive and reliable tool to quantitatively determine the N between the chlorophyll content and leaf N status and this helps to determine the right time for application of N top dressing to rice and wheat crops.

Technology: Tongue Grafting in Sohiong (*Prunus nepalensis* Serr.)

[1*]Rymbai H., [2]Patel R.K., [1]Deshmukh N.A. and [1]Jha A.K.

[1]*Division of Horticulture, ICAR Research Complex for NEH Region, Umiam – 793 103, Meghalaya, India*

[2]*ICAR-NRC for Litchi, Mushahari, P.O. Ramna, Muzaffarpur- 842 002, Bihar, India*

**Corresponding author: rymbaihort@gmail.com*

Abstract

Prunus nepalensis (Rosaceae) is an important indigenous underutilized fruit of the entire northeast India. However, it is considered as one of the important underutilized fruit crops in the hills of Khasi and Jaintia, Meghalaya. The fruit tree is growing wildly in the forest areas and as backyard crop. Since time immemorial, this fruits are being utilized by the tribal in various forms. Fruits are eaten fresh when ripened. The sohiong fruit quality is excellence with unique colour, taste and flavor. It is also richer in nutrition. It has a good potential for extraction of natural edible colour required in food industry. It is has also been observed that its colour added to squash and jam may last longer of around one year. RTS and cherry wine are also being prepared from pulp and juice of the fruit due to its imparting purple colour to the wine. The expansion of area for commercial cultivation of this crop in the state may offer generation employment and income generation for the tribal peoples. Furthermore, it is high time to popularize the crop for its proper collection and strategies management techniques for sustainable production and conservation. So far there are very few established orchard of this crop in the region. This is due to non-availability of standardized propagation technique which caused a major hindrance in multiplication and area expansion of sohiong. In view of this, a 'Tongue' grafting technique for easy and quick multiplication of sohiong was developed at the ICAR Research Complex for NEH Region, Umiam, Meghalaya, India. It was found that plants of sohiong obtained through tongue grafting were found to give higher growth characters over seedling plants with respect to all characters with the exception of plant height were maximum was recorded in seedling plant (120.56 cm). Maximum stem diameter (17.47 mm), number of branch (6.72), plant spread in E-W (49.81 cm) and N-S (42.86 cm) was recorded in grafted plants as compared to seedling plants.

Key Words: Prunus nepalensis L., Propagation, Tongue grafting

1. Introduction

Prunus nepalensis is locally known as *Sohiong*, belongs to family Rosaceae. This crop is an important indigenous underutilized fruit of the entire northeast India. It is widely distributed in different part of the northeastern region, particularly, Khasi and Jaintia Hills of Meghalaya, situated within $25^{0}1'$ and $26^{0}5'$ North latitudes and $85^{0}49'$ and $92^{0}52'$ East Longitudes with altitude ranging from 300 to 2000 m and temperature 2 ^{0}C - 36 ^{0}C. The fruit tree is growing wildly in the forest areas and as backyard crop. So far there are very few established orchard of this crop in the region. *Sohiong* has an immense potential for commercial cultivation in

the state as well in other part of the world which is relative cool climate.

Since time immemorial, this fruits are being utilized by the tribal in various forms. Fruits are eaten fresh when ripened. The *sohiong* fruit quality is excellence with unique colour, taste and flavor. It is also richer in nutrition (Rymbai et al., 2014; Deka and Rymbai, 2014). It has a good potential for extraction of natural edible colour required in food industry. It is has also been observed that its colour added to squash and jam may last longer of around one year. RTS and cherry wine are also being prepared from pulp and juice of the fruit due to its imparting purple colour to the wine. The expansion of area for commercial cultivation of this crop in the state may offer generation employment and income generation for the tribal peoples. Furthermore, it is high time to popularize the crop for its proper collection and strategies management techniques for sustainable production and conservation. However, due to non-availability of standardized propagation technique has caused a major hindrance in multiplication and area expansion of *sohiong*. In view of this, the Division of Horticlture, ICAR Research Complex for NEH Region has developed a 'Tongue' grafting technique for easy and quick multiplication of *sohiong* (Patel et al., 2011).

Among different propagation grafting techniques experimented in *sohiong*, it was found that tongue grafting was significantly produced maximum graft takes, growth and development of grafted plants. Tongue grafted plants are stronger, because the interlocking tongues are held under compression by the natural springiness, i.e. elasticity of the wood of both stock and scion. This naturally generates the pressure needed for graft union formation. The additional length of the vascular cambium exposed along the cut surfaces of a tongue graft, original diagonal cut plus tongue cut is much greater than the length of cambium exposed by only the diagonal cut without the tongue. This results in greater cambial contact between stock and scion of a tongue than of a splice graft.

2. Selection of mother plant

The main objective of mother block is to get healthy scion and making available enough scion sticks. The performance of the progenies depends entirely upon the characteristics of the mother plant. There is great variability in fruit types among different *sohiong* genotypes. Therefore, selection of the elite mother plant must be done with maximum care. The basic characteristics while selecting mother plants must be considered are;

i. Consistently high performance and yield over several years
ii. Healthy and free from incidence of diseases and insect pests
iii. Plants with good quality parameters.

The monitoring and maintenance of these mother blocks should be done regularly so that they remain healthy and free from diseases and insect pests. It must be pruned regularly to maintain

them in vegetative phase and to produce enough shoots for propagation. The prune parts should be applied with Bordeaux paste. Periodical removal of criss-cross branches, water sprouts and diseased branches is necessary.

3. Harvesting of ripened fruits

To raise seedling for rootstock, only the well ripened fruit are harvested and collected usually in the month of September – October for seed extraction. The ripened fruits are indicated by fully blackish or purplish coloured and slightly soften when touched. If fruits are not fully ripened, there may be difficulty in removal of pulp, and embryo may not be fully mature to become capable of germinate.

4. Seed extraction

The seed should be extracted from fruit by removing the flesh portion manually. This can be carried out by subjected the fruits to fermentation.

4.1. Fermentation

Fermentation of the fruits are carried out by keeping the collected fruits in a bucket containing water for a period of about 3 – 4 days. The soaking is done for quick fermentation of pulp adhering on seed, thus facilitate easy removal of the stone.

4.2. Pulp removal

Following 3 – 4 days of fermentation, the fruit pulp are removed from the stone by rubbing the fermented fruits between the palm under water or by holding it under water and using a brush, to scrub it clean. Seeds extraction can be also be done by maceration and recovered by flotation. The extracted seeds are washed in water, preferably running water and allow seeds to air dry under shade for 24 hours.

5. Raising of rootstock

5.1. Stratification

The present of dormancy in *sohiong*, prevent its seed from immediate germinate upon sowing. Seed dormancy in *sohiong* may be imposed due to its hard seed coat and internal regulated by the inner seed tissues. Therefore, *sohiong* seeds require special treatments to overcome dormancy, thereby causing it to be more ready to germinate. The seed required to be subjected to a particular duration of moist-prechilling to break dormancy for germination, this prosess is known as stratification. In stratification, the freshly extracted seed are kept in a closed pot containing alternated layers of moist sand and stored at low temperature, about 4 – 8 °C. Periodically, the medium are monitor that it should be slightly moist but not dry nor wet. The length of time of stratification is about 3 – 4 weeks, indicating by the initiation of seed coat rupturing at 3 weeks.

5.2. Primary nursery

Once the seed has completed stratification, it is ready to start growing and utilized its energy reserves at a rapid rate. The stratified and ruptured seeds can be sown during October – November in either of the following two methods;

5.2.1. Polybag

The ruptured seeds following stratification should be taken out of moist sand and sown during October –

November in polybag having thickness of 100 gauge and size of 10 x 15 x 10". The ruptured are sown in polybag containing media of equal amount of soil, sand and FYM mixture. Seed sowing depth is about 5 cm. Following which the polybag are arranged in rows for easy management. Sowing in polybag is preferred over seed bed due to easy removal of seedling while transferred the seedling to secondary nursery. The mortality rate during secondary nursery operation is minimal as the seedling are transplanting along with the earthball.

5.2.2. Seed bed

Sowing of stratified seeds can also be done in nursery bed containing equal amount of soil, sand and FYM mixture. Seed bed must be 1 m width and 10 – 15 cm above ground level. It must be fine tilt and avoid of any soil clotting and stone. Sowing depth is about 5 cm depth. Seed are sown in line at 5 cm between the seeds and 10 cm between the lines. After sowing, the seed beds are covered with straw mulch and irrigate gently. The straw mulch should be immediately removed when the germination has initiated in the bed. During transplanting to secondary nursery, a high mortality (25 - 30%) was recorded in seedling grown in primary seed bed. Therefore, the seedling must be intached with earthball as much as possible during transplanting.

6. Germination

Seeds germination starts at about 30 to 45 days after sowing. The germination percentage in *sohiong* is about 95%. *Sohiong* seed coat is hard; however, it does not required scarification prior to stratification as shown by its high percentage of seed germination. This indicates that seeds of *sohiong* do not have double dormancy. Germination of seeds can be improved by treatment with GA_3 @ 150-200 ppm or Thio-urea @ 5 g/litre water.

7. Secondary nursery

Seedling after 3 -4 months of sowing attained 15 – 20 cm height. These are transfer to secondary nursery in polybag (10x15x 20 cm) containing equal amount of soil, sand and FYM mixture. While transplanting, the earth ball must be kept intact with the roots to avoid maximum mortality. The seedling must be planted in the middle of the polybag and gently press the soil with fingers. Pressing the soil near the stem of the seedling must be avoided as it caused breakage of the roots due to its brittleness. Following transplanting, light shower irrigation must be given for proper establishment of seedlings.

8. Selection of scion

A scion of about five to six month old shoot should be selected as scion material from healthy mother plants of *sohiong*. Shoot selection should be carried out during September, when the shoots are in dormant stage. The scion stick should be of pencil thickness preferably the same size as the stock and contained with 3 to 4 internodes of 25-30 cm long containing dormant plumb buds should be used for grafting. If the stock is larger than the scion, contact can be made on only one side. The scion should never be larger than the stock.

The shoot which has initiates sprouting or shows sign of green tips of buds must be avoided, as there is very low percentage of graft take. Avoid any shoot that is older. Scion stick should be straight and have many vegetative buds. Avoid any wood with spurs containing fruit or blossom. Watersprouts, *i.e*., excessively vegetative shoots should be avoided. Avoid suckers that arise from the rootstock, below the union. One of the problems with using watersprouts is that the tissue often lacks in stored carbohydrates, which is important in the wound healing and callusing process. Shoot of moderately vigorous rather than vigorous upright sucker wood should be selected. The bud wood should be collected when buds are completely dormant and as late in the dormant season as possible to minimize the length of storage. The scion stick must be not be winter injured and must be free from pest and diseases. Scions should be severed and cut with sharp, clean knives and placed immediately in moistened plastic bags or bucket containing water. It is good practice during the harvesting of scions and the making of grafts to clean the cutting tools regularly. This may be done by flaming or immersing them in a sterilizing solution. Isopropyl (rubbing) alcohol also works well as a sterilant, although it evaporates quite readily. An alternative sterilizing solution may be prepared by mixing one part household bleach with nine parts water by volume. However, this bleach solution can be highly corrosive to certain metals.

9. Storage of Scion stick

The selected scion shoots may be used immediately for grafting after detached from the mother tree. For best results, harvest only as much scion wood as can be used for grafting during the same day. However, there is a need of storage of scion for long transportation. The scion wood must remain completely dormant, moist and healthy throughout storage. In case of large quantity of scion, all scions must be cut to a uniform length, keep their basal ends together, and tie them in bundles of known quantity (50 scions per bundle). Bundles of scion sticks may be stored in bins of moist sawdust in cold storages or under shade. However, for smaller quantities, scion sticks can be bundled, wrapped in moist newspaper, particularly the base and kept in plastic bags and stored at low temperature under shade. Label the bundles, recording the cultivar, date of harvest, and location of the stick plant. Regular check is required to avoid disease infestation. The cut ends may also be dipped in wax prior to storage to reduce desiccation. The scion sticks should never be stored along with fruits or vegetables because stored fruits and vegetables release ethylene gas. Exposure of Scion sticks to even very low levels of ethylene may cause woody plant buds to abort, kill making the scions useless.

10. Selection of rootstock

Rootstocks are used in orchards for various advantages, especially when site conditions necessitate. The various

characteristics of rootstocks that should be considered when making a selection:

1) resistant to present and potential soil pests;
2) suitable for the soil's texture, depth, and fertility;
3) compatible with soil chemistry (pH, salinity, lime content);
4) favored for the anticipated soil water availability, drainage, and irrigation practice;
5) appropriate for the orchard design and layout; and
6) compatible with scion of high yielding and quality fruits

Rootstocks exert tremendous influence on growth of scions. Selection of rootstocks is considered to have influence on the graftage success and proper formation of the union. Therefore, in *sohiong*, a seedling of one year old and pencil thickness (0.5-1.0 cm) should be selected for grafting purpose. The selected rootstocks must be healthy and free from diseases.

11. Grating time

The best time of grafting is second week September to second week of October, when stock and scion are in complete dormant condition.

12. Grafting technique

The selected rootstock and scion must be of equal diameter. There are two methods of grafting adopted successfully in *sohiong*, *viz*., Tongue grafting and Wedge grafting. The following are the steps necessary for tongue grafting in *sohiong*.

12.1. Preparation of stock

12.1.1. *First cut***:** A smooth diagonal slanting cut of 4 -5 cm long is made on the rootstock at about 15-20 cm above the ground level. The first cut with a single, smooth cut with no waves or whittling is advised. A good quality, very sharp knife is essential.

12.1.2. *Second cut***:** Another downward cut is given starting approximately 2/3rd from the top of the slanting cut and about 2 cm in length. It begins vertically, then gradually becomes nearly parallel to the first cut surface. This form a 'tongue' like structure on the stock. Remove any lateral branches on the stub that might crowd the graft as it begins to grow.

12.2. Preparation of scion

Identical and complementary cuts are made in the lower side (base) of the scion exactly matching the cut given on the rootstock. When the two pieces are laid face to face the joined unit should look straight and identical. Care should be taken to avoid touching the cut surfaces. Avoid splitting the wood and do not loosen the bark.

12.3. **Insertion of the scion**

After the cuts are made on both parts, open the cuts slightly. Push the scion into the stock together tightly enough in such a way that the cut surfaces match as closely as possible. The scion should be preferably the same diameter as the stock and cambial area, *i.e*. area just beneath the bark of both pieces must be aligned for a union to develop. However, if the scion and the stock are not of same size, *i.e.,* scion is smaller, then it is important that the scion be placed over

to one side of the rootstock to match the cambiums on one side only, rather than in the center, so that the vascular cambia match up. The lower tip of the scion should not hang over the stock. In grafting, the vascular cambium of the scion must be aligned with the vascular cambium of rootstock. In woody plants such as *sohiong* the cambium is a very thin like ribbon, of actively dividing cells located immediately beneath the bark. The cambium produces conductive tissue for the actively growing plant. This vascular cambium initiates callus tissue at the graft and bud unions. In addition, they are also known to stimulating tissue growth on the basal ends of vegetative cuttings before they have initiates rooting.

12.4. Wrapping

The union portion should be wrapped and tied properly with the 150-gauge polythene strip to firmly secure the grafts, exclude air and prevent drying. Wrapping should be overlapping between the strips. It should be started from lower portion of graftage and continues upward to avoid entry of water during irrigation or rainy days. Never allow the binding material to girdle the stem.

13. Tag the scions

It is important to put tags on the scions to avoid confusion among various genotypes of *sohiong* fruits.

14. After graft

Following grafting, the grafted plants must be kept under shade and avoid drying in the sunlight for better success of the grafts.

15. Graft take

About 80% graft success can be achieved through tongue grafting.

16. Aftercare

After care is very important to ensure high successful of graft. During the healing time, generally graft union is healed first and then they will start to grow visibly. This period of complete healing and graft union formation may take for 30-45 days after grafting depending on the type of graft and the weather. If scion buds start to open, it is not guaranteed that the graft is successful. It is not uncommon for buds to sprout to silver tip and even green tip but then die. For instance, even pruned and detached branches will often have buds sprout and open up from the reserve energy that is stored in them. Once the wood has produced about a half inch (1.25 cm) of new growth it is safe to assume the graft will live.

16.1. Irrigation

Initially, watering regularly with fine mist to avoid any dislodging and loosening the graft union. Soil must be just moist but neither too wet and not too dry. During summer when the sunlight is very high, keep the potted grafted trees in the semi shade, otherwise sunlight is beneficial for the growth of any tree.

16.2. Sprout removal

Periodically, it has to be checked for any sprout emerge or leaves growing below the graft union. Any growth/ or buds in the rootstock must be rubbed off that may have pushed leaves. Because if allow growth in the rootstock, the sap

Table 1 Comparison of grafted and seedling plant of *sohiong* (one years old)

Plant Types	Plant height (cm)	Stem diameter (mm)	Scion diameter (mm)	Number of branch	Plant canopy spread (cm)	
					East-West	North-South
Tongue grafted plant	113.14	17.47	14.17	6.72	49.81	42.86
Seedling plant	120.56	14.27	-	3.21	28.68	28.02

will be directed directly into this growth and the scion would dry and no callus formation.

16.3. Remove wrapping strip

Once the graft union are successfully formed, polythene strip are removed after 2-3 months of grafting to prevent strangling and girdling the graft by becoming too tight. The strip can be removed by carefully unwrap the tape or simply cut through the strip lengthwise with the help of sharp knife/blade to release the pressure and leave the severed tape on the branch.

16.4. Transplanting to field

Healthy plants are ready for planting within nine months after graft success.

16.5. Comparison performance of grafted and seedling plants

Plants of *sohiong* obtained through tongue grafting were found to give higher growth characters over seedling plants (Table 1). All characters were recorded maximum in grafted plants including stem diameter (17.47 mm), number of branch (6.72), plant spread in E-W (49.81 cm) and N-S (42.86 cm) with the exception of plant height were maximum was recorded in seedling plant (120.56 cm).

REFERENCES

Deka, B.C. and Rymbai, H. 2014. Status of underutilized fruit crops in Northeast India. In: *Proceeding of national Seminar on 'Strategies for conservation, improvement and utilization of underutilized fruits' organized by Central Hortiucltural Experiment Station and Society for Promotion of Horticulture,* Banalore, India on *4- 5th December, 2014.* (In Press).

Patel, R. K., Deka, Bidyut C. and Deshmukh, N, A. 2011. *Grafting in Sohiong: A novel multiplication technique*. Published by the Director, ICAR Research Complex for NEH Region, Umiam (Meghalaya).

Rymbai, H. Patel, R.K., Deshmukh, N.A., Jha, A.K., Patel, R.S. and War, G.F. 2014. Nutrients variability in *Sohiong* (*Prunus nepalensis* L.) fruit. *Biotech Article:* http://www.biotecharticles.com/Agriculture-Article/Nutrients-Variability-in-Sohiong-Prunus-Nepalensis-L-Fruit-3230.html.

In-vitro/Artificial Meat Production

K.Deepa[1],S.Senthilkumar[1], T.Suganya[1], Thirumalaisamy. G[2], J.B.Abinaya[1] and Santhosh kumar. M[2]

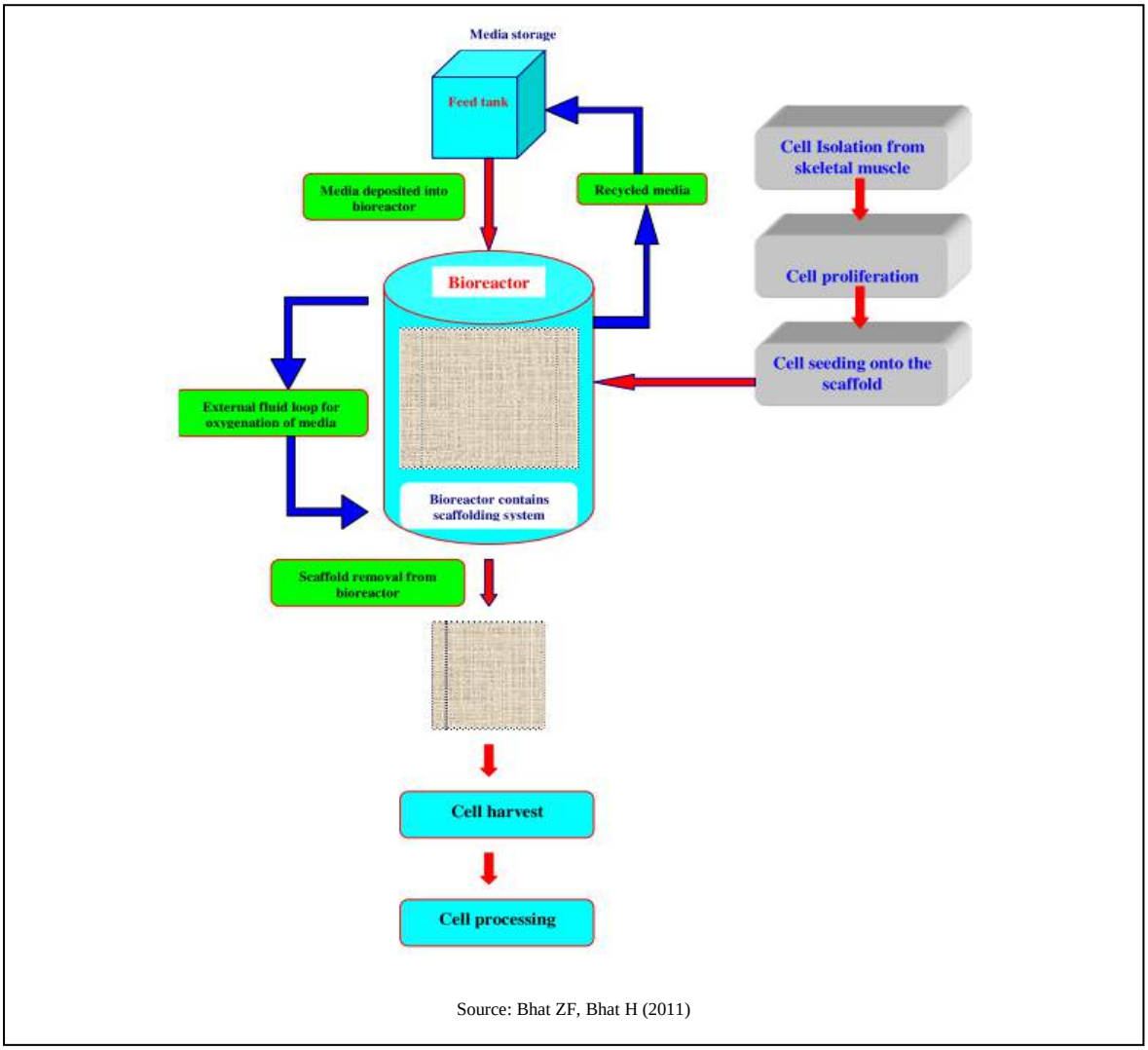
[1]Department of Animal Nutrition, Veterinary College and Research Institute, Namakkal Tamil Nadu Veterinary and Animal Sciences University – 637 002.
[2]Ph.D. Scholar, ICAR- National Dairy Research Institute, Karnal, Haryana-132 001
Corresponding author: nutritionthirumalai@gmail.com

Now-a-days the demand for healthy meat is growing and it is estimated that world's meat consumption would double by 2050 and there would not be enough livestock to meet this demand. Among the meat substitutes that are being developed is the artificial meat also called *invitro* meat or cell cultured meat, made from cultured cells and especially from stem cells. This technique was first described years ago, but has only been recently highly publicized when a cultured beef hamburger was tasted on August 5, 2013 in London. Then after, artificial meat from stem cells has been considered by the public media as a new type of meat with a great potential. If synthetically produced meat could eventually become cheap enough, however, it may feature in solutions to some of the world's hunger problems. Since it does not require the rest of the animal-production infrastructure, it may be able to accomplish this cost-savings at the same time it dodges the problems with animal hygiene and disease. Furthermore, if meat were synthetically produced, it would contain pure muscle cells only, putting manufacturers in better control of fat content and other unhealthy by-products of non-synthetic meat. By way of comparison, 18% of greenhouse gas emission is currently produced by livestock, which is more than the total emission of the transportation sector (FAO, 2006).

Methods of production

Cell culture/ Scaffolding techniques

In these techniques, embryonic myoblasts isolated from a farm animal embryo or skeletal muscle satellite cells as muscle biopsy are proliferated and attached to a scaffold or to a collagen meshwork or microcarrier beads and then introduced into a bioreactor which may be rotating or stationary and filled with a culture medium rich in nutrients and growth factors. These cells fuse to form myotubes, which differentiate into myofibers with the help of differentiation media. The resulting large number of myofibers may then be harvested from the scaffold, then minced and used in the preparation of meat products. Thus, these cell culture based techniques produce ground boneless meats with soft consistency and do not produce highly structured meats like steaks.



Source: Bhat ZF, Bhat H (2011)

However, cells can also be grown in substrates that allow for the development of ''self-organizing constructs'' that produce more rigid structures. Scaffolds developed by edible biomaterials like collagen allows 3-D tissue culture and complex structuring of meat.

Tissue culture techniques

Slices of muscle tissue are to be taken, minced and centrifuged them to form pellets, placed them in Petri dishes in a nutrient medium and grew them for a week period which closely mimic in vivo situation where the explants contain all the tissues which make up meat in the right proportions. It is already proposed that artificial capillaries can be used for the purpose of tissue-engineering and also by co-culturing the myoblasts with other cell types, like the myooids, it is possible to create a more realistic muscle structure which can be organized in much of the same way as real muscles.

Organ Printing

To provide consistency, vascularization, fat marbling or/and suitably-tasting meat unlike cell culture and tissue culture technique, organ printing technique is suitable. It involves producing organs for transplantation procedures. By using the solutions of single cells or balls of cells and spraying the mixtures onto the gels in layers fuses to create three dimensional

structures of any shape, such as rings and tubes or sheets. Thus it is feasible to produce entire organs through printing along with vascularisation.

Biophotonics

Biophotonics uses the effects of lasers to move particles of matter into certain organizational structures to bind particles of matter. Although, the mechanisms of this field are still poorly understood, this phenomenon produces so called 'optical matter' in the form of certain organizational structures such as three-dimensional chessboard, or hexagonal arrays, in which the crystalline form of materials, such as polystyrene beads, can be held together by nets of infrared light. The matter will fall apart when the light is removed. This has a binding effect among a group of particles that can lead them to move one by one to specific locations and coax them to form structures. Thus here is the possibility of producing tissue formations that use only light to hold the cells together, eliminating the need for scaffoldings.

Nanotechnology

One more prospective technique of production of synthetic meat, nanotechnology is the production and alteration of materials at the level of the atom and molecule. This highly emerging field holds out enormous possibilities keeping in view a concept of a speculative technology. The nanotechnologists are exploring all the possibilities and beneficial technological interventions that they would like to do with the help of these molecular scale sized robots. Though still commercially infeasible at the moment or in some cases technologically infeasible for several years to come, the point here is not to be distracted by the fact that we cannot yet make use of these technologies but rather to decide whether we should support the development of these technologies (Hopkins and Dacey 2008).

ADVANTAGES

- Potentially cheaper to produce than regular meat (with technological advances)
- Requires less food input (instead of growing a whole animal with bones & brains, you only need enough calories & nutrients to grow the muscle)
- Requires less water (you can use microalgae to supply nutrients to the cells instead of using water to grow corn)
- Produces less waste (no solid waste and no methane gas produced from consumption of corn or grass)
- Cleaner (a lab can be kept sterile; a farm cannot)
- More ethical in terms of animal welfare (no suffering involved)
- Healthier (scientists can have full control over fat content and nutritional content)
- Prevents climate change/global warming (a recent study found that livestock accounts for 51% of man-made greenhouse gas emissions! Much of this is from animal waste and, strangely enough, methane cow burps.)
- Better for public health (swine flu and avian flu originate from keeping animals as livestock; the less we do this, the fewer outbreaks we can expect. Feeding antibiotics to livestock is also feared to cause the emergence of new antibiotic-resistant strains of bacteria.)

DISADVANTAGES

- Very expensive to produce with current technology
- Requires enormous capital investment for Research & Development
- Unnatural
- People might be reluctant to switch over from normal meat
- Limited (for the near future) to ground meat (it's more difficult to produce a steak or drumstick)
- Subject to media criticism
- Possible unknown health consequences (Will need to be carefully tested in FDA clinical trials.)

CONCLUSION

By growing the meat in laboratories, it will endure no more suffering than a plant does growing hydroponically or out in the field. But not all animal rights supporters see a silver lining around the synthetic production of meat. If animal suffering is the only thing that makes meat production unethical, presumably we should feel fine about eating synthetically produced cat and dog meat, and maybe even human meat. Furthermore, the long term benefits of moving to a more vegetarian diet may be much better for human health and the environment than simply finding more substitutes for meat. Scientists respond to these criticisms by noting that if meat were synthetically produced, it would contain pure muscle cells only, putting manufacturers in better control of fat content and other unhealthy by-products of non-synthetic meat. Either way, it is clear that there is an essential need for agriculture and food science researchers to continue exploring currently available approaches for more sustainable food production and consumption.

REFERENCE

FAO (2006). Livestock's long shadow - Environmental issues and options. Rome: Food and Agricultural Organization of the United Nations. pp. 1 -176.

Zuhaib Fayaz Bhat, Sunil Kumar & Hina Fayaz Bhat (2015): In Vitro Meat: A Future Animal-Free Harvest, Critical Reviews in Food Science and Nutrition,

Bhat ZF, Bhat H (2011) Tissue engineered meat- future meat. J Stored Prod Postharvest Res 2:1 – 10

Hopkins P, Dacey A. 2008. Vegetarian meat: Could technology save animals and satisfy meat eaters?. Journal of Agricultural and Environmental Ethics 21(6): 579 – 596.

Management of Stray Cattle in Urban Area

T. K. S. Rao, S. Chaurasia, A. Singh and V. V. Gamit

Vanbandhu College of Veterinary Science & Animal Husbandry
Navsari Agricultural University, Navsari 396 450 Gujarat
Corresponding Author: tksrao.vet@gmail.com

Abstract:

Menace of stray cattle is very prominent problems in most of the city. Common enemies of stray cattle include accidents by vehicles, dog bites, children throwing stones and irritating them. They prefers road side kacha bedding as compared to pakka road, however they prefer road surface during rainy season. Tracking the path and behavior of stray animals are essential using GPS system. Stary animals should not be punished or killed brutally as it violates the IPC- 428, 429 and also public sentiments. Shelter may be prepared in road side in fallow or government land in town or city area to control the menace of roaming on roads and dung in shelter can be collected and detoxified and value aided. Killing of stray animals may also disturb the biodiversity of system. Gosadan and Goshala need to be established for suffering animals. Animal welfare fund need to raised and generated. Sexed semen should be made available for reducing unwanted cattle on road.

Total number of livestock in India is 512.05 million (19th Census, GOI) and total cows in India is 190.90 million. However exact data of stray animals including cattle is lacking. Increasing urbanization bringing cows to vicinity of cities, where they find their way to graze on waste, garbage and tanks. Animals abandoned by farmers with the decline of agricultural activities in past decades. These animals survived and produced offspring, which have become stray animals especially cattle in the territory. Stray animals occasionally cause disturbance to the traffic when they wander onto public roads. Public and road users fills that they literally serve as "speed breaker" for motorists, hindering the road traffic on many busy route. Cattle and buffalo may also eat farmers' crops. Prevalence of animals wandering across the public roads is common contributing to traffic accidents. Besides, concerns about animal welfare and public safety must also be taken into account when the administration is devising a strategy to control the cattle and buffalo population. Stray cattle menace is a serious issue. Cattle owners, who rear them in city area, do not bother to take them to the sheds especially during nights. Common enemies of stray cattle include dogs, children throwing stones and irritating them. Vehicles hit them regularly while crossing

or moving on road. Common saying is don't feed stray animals. You know why, "Because they breed. You're facilitating the problem if you give an animal ample food supply. But it is not true, if we will be able to manage the stray animals scientifically.

Physiology of stray animals: The physiology of stray animals is very similar to normal animals with respect to age, stage and condition of cow.

Production status: Production status is less or very small in stray animals, however the dung and urine can be collected and utilized for benefits of agriculture or as fuel.

Behavior of stray: Behavior of stray animals are like normal animal or more refine and selective as compared to normal animals as they have choice to shift as per comfort status of environment. Stray animals by default prefer soft contented and loosen up bedding. They usually reported to prefer sand bedding which is kept construction purpose. They generally also prefers road side kacha bedding as compared to pakka road, however they prefer raised metal road surface during the time and after rain during rainy season. Stary animals may sits on garbage damping ground as it provide soft ground to the animals. Cow prefers to stay closer to road side garbage fire created by local people during winter to avoid low temperature exposure. Almost all behaviors are displayed by the animals with respect nine system of behaviors like Ingestive behavior, eliminative behavior, sexual behavior, care giving or epimelitic behavior, care soliciting or et-epimelitic behavior, agonistic behavior, allelomimetic behavior, shelter selecting behavior and investigatory/ exploratory behavior. They also show refined behavior like

1. Care dependency relationship: Especially with calf and young ones.
2. Dominance-subordinate relationship:
3. Sexual relationship: This relationship is common among cyclic animals.
4. Leader-follower relationship
5. Relationship between two different

Garbage bedding for stray cattle

Sand bedding & shade seeking in cows

Inter and intra species Association: Both the association was prominent in stray cattle. They generally live in herd or group form to avoid untoward effect. Some time if one member of herd is running other also starts running as simulation model.

It is frequently observed that when dog attacks on piglets, piglets start screaming and stray cow use to chase dog

in favor of piglets to give temporary protection from dog.

Empty activity: Empty activity is very common in stray animals. Repetitive coping behavior help animals manage psychological stresses efficiently. Tongue playing behavior related with stress, nutritional insufficiency and abomasal ulcers (Wiepkema et al., 1987).

Stray cattles tress passing road in Delhi

Stray cattles sitting on roads at Chandigarh

Tracking the behavior and path of stray animals: Tracking the path and behavior of animals are most crucial especially with respect to stray animals using GPS system

Operating stray cattle/ Rumenotomy of cattle :

Sick cows from road side when operated 70 kg plastic bag was recovered, as stony hard materials (Karuna Society for animal and Nature, Andhra Pradesh 2010). Nails and vermilions are also obtained from intestine of stray cattles.

Stray animal laws in India:

1. Animal should not be given poisonous substance
2. It is illegal to kill homeless animal, municipalities can sterilize the animals i.e., ABC (animal birth control).
3. It is illegal to maim or cause injury to any animals like throwing acid, purposely killing or injuring animals [IPC-428, 429]. If any vehicle hit the animal on road, complaint can be filed against vehicle number to nearest police station using same act of IPC.
4. Stray animal should not be used for research.
5. Cows should not be left on street as they are prone to plastic bag, garbage, broken glass, nails, wires etc.

Management of stray animals: Shelter may be prepared in road side in fallow or government land in town or city area to control the menace of roaming on roads and dung in shelter can be collected for better utilization and benefits.

For stray cattle or buffalo that are reported to be sick or injured, animal management team will visit and try to locate the animal. Officers on special duty will require assessing whether the animal can be treated on site or needs to be caught and returned to an animal

management centre for treatment. Occasionally, injury or sickness may be so severe or untreatable that euthanasia by a Veterinary Officer might be required on the spot in the interests of the welfare of the animal. A dedicated team effort with the aim of long-term management of cattle and buffalo is required to ensure that they co-exist with local residents in harmony. To achieve this goal, multiple approaches will be adopted and implemented in phases.

Some silent points with respect to management include:

1. Use of scientific survey to know distribution and number of cattle.
2. Use of GPS collar to track movement including distance travelled, route adopted and area in habitat or area of liking.
3. Controlling population by castration of males and sterilizing female cattle by surgery and chemical sterilization as well is very essential. As "a single cow can produce between 250 and 500 litres of methane a day" and USA claims that Indian cow even produces more than American cow and India alone contributes 15.1% of total green house gas total.
4. Special person may be appointed for on road control of animal or in problem area.
5. Relocation of cattle from problem area to other allotted place.
6. Fencing or use of cattle grid nearby roads.
7. Isolation of animals and feeding kitchen residue and special provision for green fodder/grazing facilities may be provided.
8. Re-domestication may be tried.
9. Animals may not be utilized for training or research for the veterinary near by area. As it may spread the infection to domestic animals. Sterilization may be practiced by veterinarians.
10. A ban should be imposed on rearing cattle, pig and horse rearing in city area.bli
11. License system should be established for rearing domestic animals in city area.
12. Gosadan should be full utilized and new gosadan need to be established.
13. Training regarding management of stray cattle and their control is required.
14. Rehabilitation or for adoption of cows at gosadan will need to explore.
15. Animal welfare fund need to raised and generated.
16. Sexed semen should be made available for producing predominantly female progeny which ultimately reduce number of stray cattle.
17. All cattle keepers were supposed to keep their cattle tethered especially near town and city.
18. Fine should be charged to animal owner involve in stray cattle menace
19. Adoption of stray animals should be strengthen.

20. Helpline can be started regarding dangerous stray animal in particular area.
21. Proper identification system to the cattle should be applied and tagged with name of owner in form of rumen bolus or ear chip identification device to track the owner.
22. A license system should strengthen for keeping or purchasing animals especially for welfare status and maintenance of milk quality at door.
23. Five freedoms should be maintained at farmer door step or at shelter or NGO running stray cattle farm like freedom from hunger and thirst; freedom from thermal and physical discomfort; freedom from injury, disease and pain; freedom to express most normal patterns of behavior and freedom from fear and distress (Gill, 2015).
24. NGO should be introduced in the area for catching, controlling, feeding and treating stray animals by expert veterinary doctors.
25. Development of integrated cattle centres (gokul grams) for keeping at least 40% of stray cattle in total herd other animals may be productive with the purpose of conserving indigenous breeds.

CONCLUSION:

Stray should not be considered as burden to the society. It must be managed in scientific way in special shelter farm with purpose of conserving our indigenous breed as these breeds are resistant to heat stress and teak problems and protects our biodiversity which ultimately maintain ecosystem.

REFERENCES

Animal laws in India. Available at http://www.strawindia.org/STRAWPAGES/Laws-btm.htm (accessed 20th February 2016).

Gill, R. (2015). The five freedoms of cattle. Available at http://animalscience.tamu.edu/2015/05/22/the-five-freedoms-of-cattle. (accessed on 23rd February 2016).

Livestock census (2012). Government of India.

Stray cattle to be housed in cattle centres. Available at http://www.thehindu.com/news/national/stray-cows-to-be-housed-in-cattle-centres (accessed on 23 February, 2016).

Plastic cow project. Available at http://www.theplasticcow.org/what-is-a-plastic-cow/what-is-a-plastic-cow.html. (accessed on 23rd February 2016).

Wiepkema, P. R., Van Hellemond, K. K., Roessingh, P. and Romberg, H. (1987). Behavior and abomasal damage in individual veal calves. Applied Animal Behavior Science, 18: 257-268.