Journal of the Andaman Science Association Vol. 24(1):45-55 (2019)
ISSN 0970-4183, Printed in India

Livestock Production Challenges in The Bay Islands and Their Mitigation

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Abstract

The Andaman and Nicobar islands with an area of 8249 sq.km are the largest archipelago system in the Bay of Bengal. According to the last census, these islands have 3.81 human population and total livestock population of 154750 including crossbred animals. The total milk production was 25 lakh liters in year 2012 and per capita availability of milk at these Islands was 185 ml/day and per capita meat/eggs availability was about one kg/ annum and 168 eggs. The total poultry population was 1165363 in the year 2003. At present the population of the islands is hovering near 9 lakhs and an extra 6 lakhs tourists visits the islands on yearly basis, which pushes these resource poor islands to huge shortage of animal products to support this population. At present per capita availability of milk is 113g, with an import of 16.2 lakh litres and total production of 16 lakh liters per annum. It is obvious the productivity of the birds and animals are very low, which is mainly due to severe scarcity of feed and fodders in the islands. There is 99% shortage of green fodder, 52% shortage of dry fodder and 97% concentrates/grain mixture shortage in the islands. Thus, meeting the demand for feeds and fodder and preserving potential germplasm are the big challenges. To bridge these challenges line departments along with ICAR-CIARI and extension agencies need to exert multi-dimensional combined efforts.

Key words: *animal rearing, health problems, improved practices, production*

Introduction

The Livestock provide not only food and income security but also provide social status, insurance and cultural values, employment especially of women which are still highly regarded by farming communities in most part of our country. In the islands, livestock rearing is done mostly by small and marginal farmers with holding size of 1-2 cattle/ buffalo and 2-3 dozens of backyard poultry birds per household in rural Andaman. There are few large herds of cattle in the in south Andaman for supply of milk to the consumers of Port Blair town. Poultry are reared by (women) farmers in small numbers to meet their own requirement of eggs and meat; surplus is sold in local markets. The total milk production was 16 lakh liters in year 2012 and per capita availability of milk at these Islands was 185 ml/day and per capita meat/ eggs availability was about one kg/ annum and 168 eggs. Due to immigration of different classes of workers and other investors from mail land India in different sectors (mainly tourism), at present the population of the islands is hovering near 9 lakhs and an extra 6 lakhs tourists visits the islands on yearly basis, which pushes these resource poor islands to huge shortage of animal products to support this population. At present per capita availability of milk is 113g, with an import of 16.2 lakh liters and local total production of 16 lakh liters per annum. The rural household women farmer prefers poultry to cater the need of meat, egg and instant cash money. It is obvious the productivity of the birds and animals are very low, which is mainly due to severe scarcity of feed and fodders in the islands and the climatic condition of the islands (farmers are unaware). According to the recent data available, there is 99% shortage of green fodder, 52% shortage of dry fodder and 97% concentrates/grain mixture shortage in the islands. Generally, India follows the western countries and US after decades for the rearing system to practice livestock rearing and the islands follows mainland India, then. The ecology and climatic condition of the islands are totally different from the mainland India, thus to give both agriculture and livestock rearing a sustainable approach we need to understand the ecological (and climate), socio-economic and cultural limitations to design a suitable system. To bridge these challenges line departments along with ICAR-CIARI and extension agencies need to exert multi-dimensional combined efforts.

Further, we should be proactive to support anticipated future development of the islands. After opening of international airport, there would be increase in the number of tourists visiting the islands. At present the pollution in the islands is negligible, even though we should be cautious enough not to disturb the carbon sink and the agriculture and animal rearing system we would opt in future should be of less emissive in nature or supported by proper mitigating strategy/plan.

Livestock sector plays a crucial role in rural economy and livelihood of the islanders. The overall growth rate in this sector is steady and is around 6%. Ownership of the livestock is evenly distributed with poor and marginal farmers, and organized livestock farming is very rare. It is well known fact that livestock farming along with agriculture imparts more balanced and sustainable development of the rural economy. Currently per capita availability of animal products is less than the ICMR norms. Improvement in this sector will provide nutritional security, income and employment. Nowadays, due to awareness creation by ICAR-CIARI and extension departments the un-employed youths are embracing livestock and poultry rearing as their vocation. But, their nightmare is the availability of feed, which incurs more than 70% rearing cost of any bird or animal production. Thus, here focus is how we can address the low productivity of the livestock sector and possible interventions required from the resourceful players in the sector.

Methodology

This study was conducted based on secondary information pertaining to Andaman and Nicobar Islands. The islands had total population of 3.8 lakh (Census, 2011) and more than 82%literacy rate. The Union Territory of Andaman and Nicobar Islands is divided into three districts namely South Andaman, North and Middle Andaman and Nicobar and further subdivided into four subdivisions with 11 Tehsils and 204 revenue villages (Census villages 547). But, the present population is hovering near 9 lakhs, with a huge influx of blue and pink (daily wage labourers) collar job seekers to the islands. According to the inhabitants of the islands, the real pace in development of the islands started after 1995 and it saw a new sunshine after the devastating Tsunami, when the islands were implicated with huge loss in every arena and came into limelight of media and people of mainland India and other philanthropic countries. The immigration was neither encouraged nor discouraged, but there were huge shortage of different types of workers in the islands. The secondary sources were also used to generate comprehensive database for the study. The data was collected from Governmental data books, Directorate of economics survey and data from Central Island Agricultural Research Institute and field data.

Results and discussion

Prevailing animal rearing practices and related problems

Andaman and Nicobar group of islands have total geographical area of 8, 249 sq.km with a coast line of 1,962 km. The 90 percent of land area of the Andaman is reserved or protected forest of which 36 percent is tribal reserve. The total area of Andaman covers 6340 sq.km and Nicobar group covers 1841 sq.km. The land distribution was not uniform in the islands. The early rehabilitation system allowed each settler with 4.4 ha of land consisting of 2 ha of paddy land, 2 ha of hilly land and 0.4 ha land for the homestead. But, latter got only 2.5-5 acre of land with agricultural inputs or land for commercial purpose with inputs. In the last four decades, there has been a spurt of immigration from mainland India, mainly from West Bengal, Tamil Nadu and Kerala. Similarly, after the Tsunami there was huge influx of workers of different class from mainland India to support the flourishing tourism and vast construction industry. Mono cropping of paddy, haphazard planting of coconut, areca-nut, and few fruit trees in the backyard were the usual practices in the agricultural sector. However, great loss due to tsunami had disturbed the agriculture and allied sectors of these islands in the year 2004, when several hectares (about 6000 ha.) of cultivable land turned salty due to Tsunami and become unsuitable for agriculture.

Amongst the field crops rice is the major crop, occupying about 7685.47 ha (2011-12), with productivity

of about 2.20 t/ha, cropping intensity as revealed by dismally low at 105 percent. However, the cropping area was 317.3 ha in the year 2013-14. Rice cultivation was practiced in Little Andaman, remaining south Andaman, Middle and North Andaman, but due to uprising of areca-nut and coconut plantation the area under rice cultivation and banana plantation has decreased drastically during the years. Now, rice is cultivated sporadically in north and middle Andaman only, where both coconut and areca-nut plantation cannot be practiced due to water logging condition or any other reason. Before Tsunami, banana was cultivated in Little Andaman and Havelock islands in a very vast area, but now those areas are engulfed by the nuts plantation. Similarly, vegetables in the Port Blair used to come from Little Andaman, Havelock, Neil and North and middle Andaman, but now the scenario is changed. Vegetables are grown at south Andaman and some comes from North Andaman, very little from Neil and Little Andaman. Little Andaman caters the Nicobar Islands need over the Nicobar's local production. Vegetables are really scare commodity in the islands, which fetch very high price at the local market due to very high demand. As said earlier, the resourceful farmers are indifferent to agriculture, so with vegetable growing. Several areas of South Andaman (Hamfrigunj, Manglutan, Wandoor, R.K. Pur, V.K. Pur, etc.) who used to supply the main chunk of vegetables to the Port Blair market is now supplied by the landless farmers of mainland India, who cultivates vegetable in the leased land of settlers. The farmers are also indifferent to agriculture due to lack of supply of pesticides and fertilizers (the islands are declared organic).

The livestock farming depends on the success of agriculture and its thrives in tandem with agriculture, here in this region it has suffered mostly due to low intensity of crop production and several other location specific problems viz. poor germplasm, unavailability of good quality forage, higher cost of commercial feed, unfavorable environment, animal health problems and transportation of goods and marketing difficulties. However, recently livestock and poultry farming in these islands has gained a significant improvement and emerged as one of the major source of self-employment and subsidiary income.

During rehabilitation the settlers were distributed with descriptive breeds of animals in the islands. Though the life was very tough then due to unavailability of proper transport and communication facility, the people were getting quite good amount of animal's product. Till date Andaman and Nicobar islands do not have any breeding policy and in due course of time indiscriminate breeding made the animals un-descriptive in nature. At present livestock populations in the islands consist of nondescript cattle, buffaloes, pigs, and goats. As per the 1997 census, total livestock population on the islands was 188311 including 5400 crossbred animals. The total milk production was 25 lakh litres in the year 2012, with per day average milk yield was about 1.5 liters for cows and 1.5- 2.0 liters for buffaloes.

The livestock supports the agriculture in the form of draft power. Majority of farmers are following the concept of integrated farming in these islands for optimum use of land. The total poultry population was 800950 in year 1997 and it further increased to 1165363 in the year 2003. Common practice of households in Islands is to have some poultry birds in the back yard. Animal Husbandry sector provides large self-employment opportunities to the farm women. Livestock Sector not only provides essential protein and nutritious human diet through milk, eggs, meat etc but also plays an important role in utilization of non-edible agricultural by-products. Livestock also provides raw material/by products such as hides and skins, blood, bone, fat etc. At present the population of the islands is hovering near 9 lakhs and an extra 6 lakhs tourists visits the islands on yearly basis, which pushes these resource poor islands to huge shortage of animal products to support this population. At present per capita availability of milk is 113g, with an import of 16.2 lakh litres and total local production of 16 lakh liters per annum. It is obvious the productivity of the birds and animals are very low, which is mainly due to severe scarcity of feed and fodders in the islands. Thus, meeting the demand for feeds and fodder and preserving potential germplasm are the big challenges.

Constraints and problems in livestock production system

These Islands are far away from mainland and the input supplies are mainly dependent on mainland, which is most often uncertain and costly affair. Several studies have been conducted by ICAR-CIARI, to register the major constraints in livestock rearing. The most important one expressed by the respondents have reflected that shortage of fodder especially during dry season followed by shortage of fodder during rainy season. After Tsunami most of the valley lands used for grazing inundated by sea and hence, farmers are facing severe deficiency of fodder. Similarly, during dry spell of summer farmer face acute deficiency of fodder.

Settler's indifferent attitude towards animal (cattle and buffalo) rearing

Yes, the islanders are indifferent to rear animals by their own. The animals are mainly reared by the poor and marginal farmers. If not fully organised, semi-organised farms are very rare in the islands, one is at Indira Nagar (Wandoor). The resourceful farmers have different thought for his vast land holding. They prefer hassle free cash crops like areca-nut and coconut, where no regular inputs are necessary and sometimes the well-doing resourceful farmer would giveaway this plantation in lease for 2-5 year duration. If the plantation is not on lease, he would allow the nut collector to milk the plantation on contract basis. These practices make the farmers live a hassle free life in the islands.

Whereas, a livestock farmer is bound to face the following problems while rearing their animals

a. Feed shortage
b. Poor breed of animals
c. High price of commercial feed
d. Lack of proper scientific rearing knowledge
e. Less availability of grazing land
f. Hear the music of neighbour, if the animal gets free of its tag
g. Shortage of fodder during rainy and non-rainy seasons (Mid October to May)
h. Lack of money
i. Poor health cover for the birds and animals
j. Poor marketing facility
k. Lack of Governmental support for marketing milk
l. Lack of labour

Above all these problems, the farmers are also distracted by the flourishing tourism and construction work all over the islands.

Problems in poultry farming in the islands

Backyard poultry rearing is just like a culture of the rural Bengali farmers in the islands. The farmers are apathetic towards awareness and rarely follow scientific knowledge of rearing. The farmers are unaware of importance of vaccination, medication, feed additives and supplements. They approach the local vet only when the chickens are in moribund condition or half of their flock is wiped off, and seldom follow any control measure for any disease. There is no systemic or organized production and marketing of the poultry. Rural farmers are reluctant to transport their birds to the weekly fair the "Sunday market" where they can fetch handsome cost for their birds. They are happy if they can sale the birds at their doorstep. Here the shopkeepers, who sale the dressed birds fetch the birds with great profit from the farmers and thus creating a monopoly in the market. Moreover, the farmers have no part in deciding the market price of their product. To add on this, to the dismay the islands do not have any cold storage facility neither for eggs nor for meat. The farmers prefer non-descriptive country birds, which are poor layers and so their growth rate. The nondescript birds found in these islands seems to be the crosses of the following breeds like Australorp, Sussex, Rhod Island Red, New Hampshire, Plymouth Rock, White Leghorn, Aseel, Naked Neck, Nicobari, Frizzle and many other non-descript desi birds.

Problems in pig rearing in the islands

The pigs are reared in both groups of islands, the Andaman and Nicobar. In Nicobar, the tribes there rear pigs in small village units and have amicable and very good bonding with their pigs. But, they fail in case of breeding the animals. They prefer the best one to sacrifice for the special occasion in calendar, which make them to lose the best to breed for the future sounder. The extensive system of rearing causes productive energy to lose, which could be used for faster growth of the animals. Moreover, there is no proper diet or ration followed by the Nicobarese. Feeding coconut (high fat nut) to the growing animals may cause inefficient digestion of fibre in diet, in turn decreasing the feed conversion efficiency of the pigs. In Andamans, pig rearing is taboo in Muslim community and in certain Hindus also have a notion that rearing pigs may affect their social status or pigs are reared by people of lower social stratum. Generally, animal rearing is seldom allowed in municipal areas openly or one cannot free range the animals in such areas. The farmers who rear pigs outskirt the city seldom use pukka floor, thus the pigs are untidy, dirty, rolling in muddy areas and production is unhygienic. Here too, the farmers seldom follow scientific feeding and management. This sector too is unorganised and in spite of huge demand of pork in the market, there is no systematic supply at the market.

Problems in goat rearing in the islands

The goats are reared in the islands only for meat purpose, as the goat milk is neither relished by the farmers nor sold at market. As chevon is devoid of any social taboo, are sacrificed by both Hindu and Muslims for their ceremonial worship. Andaman breed of goat (cross of Black Bengal) is the predominant breed in the islands. Farmers are not having good stock to breed and rear. Islanders do not rear goats intensively and lack of grazing land and rearing space, small land of the farmer makes goat rearing a challenge. Several times the goats sneak into the neighbour's garden or field, culminating into violent quarrel among the neighbours. Moreover, vegetables and horticulture trees are tonsured by the goats, which discourage the farmers to opt goatery. Due to huge shortage of feed and fodders in the islands, the farmers dare not rear goats. Times come when unstoppable rain showers for weeks in the islands making the goats to be confined into their pen and in such condition the farmer is helpless in the absence of storage feed. The farmers who rear goats are indifferent to the growth rate of the goats, as the sale happens on the basis of piece (head basis) rather on the body weight of the animal. Now, the efforts are exerted by Animal Science Division of ICAR-CIARI for creating awareness on the scientific rearing, feed formulation, breeding strategy, feed conversion ratio, etc.

Strategies to mitigate the challenges of livestock and poultry production in Andaman

The technological model cannot be copied as such from the productive mainland or else areas (western countries or US) to these islands due to variation in socio-economic and climatic conditions. Therefore, to improve the productivity, suitable policy, environment and supporting infrastructure have to be provided. In view of the ecological and socio economic constraints to livestock production system, proper strategies need to be devised.

1. Planning and initial course of work

As the saying "good planning is the halfway to success" a plan is imperative and the following interventions need to be done urgently. We need to estimate the potential of not only fallow land but also road side land, waste land and potential hilly terrains which can be used for fodder production. Generally, every Panchayat has certain land area which is not used, so we should tap the chances of possibility of leasing those lands. Most importantly, we should urge the administration to get released grazing land from the encroachers, where grassland development can be done including an aim of establishing a "Grass Reserves". Thus, we can develop a Block/village Grazing cum-Fodder and Pasture Management system. Along with this we need to impart Awareness and training on improved management to the livestock farmers.

2. Improved breed and health management programme

The selection of breed adaptable to the existing agro climatic conditions that can thrive on unconventional feed

and fodder resources should be given priority in livestock management programme. There is need to encourage the farmers to breed local non-descript animal with improved breeds through Artificial Insemination (AI) and adopt pregnancy diagnosis (PD) as a tool to avoid the losses. Moreover, A & N administration is on the way to procure good germplasm of dairy animals from the mainland India by Embryo transfer technology, which will surely improve the productive potential of island animals.

3. Improved feeding practices

Balanced feeding of animals is very important to address global warming, eutrophication from animal excreta, improved or better growth and production of animals and high revenue generation. The efforts from the extension agencies should be made to make aware the farmers, of importance and functions of concentrate feeding, viatmins and supplements, and minerals in animal diets. The dissemination of simple and cost effective technologies like chaffing of fodder, urea or ammonization of straw and supplementation of mineral salt could enhance the productive and reproductive efficiency of the livestock and poultry.

4. Curbing the stray cattle menace in the islands

As per my memory, stray cattle in islands are there long back in 1980s and so their menace. We need to ponder as these animals are threat to the agriculture farms, causing blockade of the only arterial road (ATR road) and sometime causing accidents and attacks. The Goushalas can manage these animals are use for productive purpose. Two such Goshala volunteers are there, one at Mithakhari (South Andaman) and second at Diglipur (North Andaman), would certainly do the needful if get some support in terms of technologies and construction plan.

5. Production and enhancement of fodder availability in the islands

The scheme incorporates the following components/ technology interventions:

a) Status of fodder production

Feed alone accounts for 70% or more of the rearing cost of the animals or birds. It was learned that green fodder was about 99% deficit followed by concentrates (97%) and dry fodder was deficit by 52 percent in the islands. The non availability of feeds and fodder is the major challenge to sustain the livestock. Due to heavy rains for about 8-9 months, green fodder cultivation is difficult and further processing of these fodders to dry (hay) and silage making. Similarly, cereals, which can be used as feed ingredients also not cultivated due to different attitude and invasion of cash crops.

b) Fodder for the animals

It is very true that we can rear medium yielding dairy animals (cattle and buffalo) and goats (mainly meat purpose) only with fodder of high to medium quality. The cattle and buffalo which produce milk up to 5-6 liters can very well be supported by only fodder diet. The islanders rear goats mainly for meat purpose and seldom use milk for consumption, which again can be well supported by only fodder diet (also tree fodder). Similarly, pigs can also thrive well with fodder as main chunk of the feed along with supplemental mixture of root/tubers (or grain mixture). Backyard poultry graze on grasses and devour insects present around the houses. A high quality legume fodder (Azolla/Cowpea) can be a good primary feed for the backyard poultry with supplemental kitchen waste (left over human food, vegetable or fruit waste, etc).

c) Inter-cropping fodders and use of fallow land

As the government allotted grazing lands to the islanders are encroached by the landless immigrants and the settlers too, the only option remain with the islanders is grazing at road side and fallow land, cultivation of fodder in waste land and hilly terrains. The shortage of fodder can be tackled by utilization of traditional/ local feeds/ fodder crops with proper intercropping system between the coconut and areca-nut plantation. The annual and perennial fodder crop/ trees can be incorporated in the crop calendar. Fodders like Napier Bajra hybrid and Guinea grass are good option and have been successfully intercropped with coconut/areca nut plantation in south India. Maize and Sudan grass are very good intercrop option for both coconut/areca nut plantations in India. But, fodder like maize grows strong taproot deep into

the soil and will improve the soil condition physically by breaking plow sole and require lot of nitrogen in the soil, thus crop rotation is always advisable. The suitable storage mechanism for the fodder and feeds may be adopted with proper technology backup.

d) Use of unconventional fodder resources (multipurpose crop plants and trees)

In most cases multipurpose trees and plants have a primary role such as being part of a living fence, a windbreak, or used in an ally cropping system by the farmer. In addition to this they will have one or more secondary roles, most often serving to supply a family with food, firewood, and forage (most common is *Gllyricidia*). Unconventional fodder resources, like tree fodders and utilization of forest resources as source of fodder with participatory management has high scope. As the islands are declared "Organic" the tree species like Acacia, Prosopis, Leucaena, Gliricidia, Guazuma, Inga, Albizia, Cassia, *Pithecellobium* and *Alnus spp*., can be used for increasing the soil fertility and increasing the tree fodder production for the animals in fallow land. Unconventional feeds generally have anti-nutritional factors thus can be fed to the ruminants with little processing and precaution, while these feeds are not advisable for the monogastrics such as pigs and poultry. The tree fodders can be grown in fallow/waste land, as barrier/wind shields for the houses or farms, fence (*Glyricidia* is extensively used in the islands) and both side of the bunds.

e) Encourage farmers to take up fodder production as business

Watching the severe scarcity of feed to support the livestock, farmers can be encouraged to take up fodder production as business. This can be well accepted by the large farmers, having large land holding. They can also preserve and sale the fodders in off seasons to earn good profit out of this.

f) Use of alternate feed resources

Exploring alternate feeds and supplements such as fish meal and coconut meal, which are abundant in the islands can be a good step towards making the islands self sustainable in term of feed resources of the islands. The islands are blessed with abundant mangrove plants, thus there is need to tap the possibility if these plants can be used as fodders for the island's livestock. The islands are also bestowed with huge quantity of sea weeds at the shore area, if not directly fed to the animals silage is a possible intervention. Silage is known to reduce the anti-nutritional factors in the final product, which are possible unwanted factors in the sea weeds.

g) Hydroponics as Green Fodder

Growing fodder plants without use of soil just in mineral nutrient solutions in water. Like greenhouses, hydroponic can have total control over the climate - temperature, humidity, light intensification, the composition of the air. Thus, season is not at all a concern and fodder can be grown all year round. Maize, pulses, wheat, and horse gram seeds are preferred hydroponic fodder but do not use pearl millet and sorghum seeds because these sprouted leaves contain poison that can harm your livestock. Hydroponics is also good in the sense, it has better growth rate in plants, less labour intensive, gives a better efficiency of nutrient use, uses 10% water compared to field grown fodders and it require less space.

h) Complete feed blocks

Complete feed block (CFB) can help the farmers to practice feeding balanced ration to his animals in turn increase the production. CFB is made from forage, concentrate and other supplementary nutrients in desired proportion capable to fulfill nutrient requirements of animals (ruminants). CBF is not only an economic viable technique but also has multiple advantages like easy transportation, easy storage, correcting nutritional deficiencies, easy handling and reduces feeding cost. CFB can be prepared out of forest tree leaves (which are non toxic in nature), with incorporation of urea and molasses (jaggery solution, as molasses not available here) to increase protein and energy, respectively. Establishment of Fodder Block Making Units will help the animals to meet out their feed need during the lean period of the year. Moreover, this unit may serve as the supply during

the disaster strike to the islands (Tsunami, earth quake, draught of any type, etc).

i) Fodder Seed Production and Distribution

ICAR-CIARI is having the fodders like Hybrid napier, CO-3, CO-4, Guinea grass and DHN-6, which are grown in the fodder fields of the campus and time to time the cutting of the fodder stalks are distributed to the needy farmers as inputs to propagate fodder to the farmer's fields to satiate their livestock. A plan is also in pipe line to establish a fodder garden at the ICAR-CIARI campus to supply the fodder stalks to farmers as regular inputs with collaboration with ICAR-IGFRI, Jhansi, MP.

j) Dissemination of package of practices

A wholesome package of practices for profitable livestock farming in the inlands has to be prepared and provided to the farmers. ICAR-CIARI is working on this issue and will come with a suitable PoP very soon. Along with this the following practices are also recommended

i. Introduction of Chaff cutters

A chaff cutter mechanically cuts straw, hay or large grasses (fodders) into small pieces before being fed to cattle, buffalo or goats. It increases the surface area of the fodder for better action of ruminal microbes and gut enzymes for better digestion. Cutting the fodder into small pieces also reduces the rejection as well as minimises the wastage by the animals. There is hand operated and Hand Cum Power Operated Chaff-Cutter in the market. Thus, a farmer having small to large number of animals can choose his cutter based on his need and efficiency he is intended.

ii. Area Specific Mineral Mixture (ASMM)

Minerals are required by the animals for their maintenance of metabolic functions, growth, milk production, reproduction, immunity and health status. Animals cannot synthesize minerals inside their body and generally feed and water do not provide all the minerals in the required quantity to the animals. Therefore, animal should be supplemented with adequate amount of good quality mineral mixture in their feed.

The supplemental mineral requirement by the animals depends on the mineral content in feed and fodder they eat, which in turn rely on the area where they are grown and varies from region to region. So, it is necessary to prepare region/area specific mineral mixture. Balanced mineral feeding to the animals is known to have several benefits like boosting immunity and better resistance against diseases, provides better feed conversion ratio, improves growth rate in young animals and early puberty, reduced inter calving period, increased milk SNF and production and increased reproductive efficiency and life in both sexes of the animals.

iii. Feed Pelleting

Basically, the purpose of pelleting is to make larger particles from finely ground dusty, sometimes unpalatable and difficult-to-handle feed materials by using heat, moisture and pressure. Pelleting make the feedstuffs more digestible by breaking down the starches by heat and moisture and increases palatability. Pellet feeding causes less wastage of feed and increases feed conversion ratio.

k) Establishment of silage making units

Silage making can be a very good step to address the fodder scarcity during the lean period (Jan-April) in the islands. Silage can be prepared from grasses (natural pasture and hybrids), tree leaves and vegetable market wastes. The fodders having high soluble carbohydrates like maize, ordinary grasses, sorghum, oats, pearl millet, and hybrid napier make very good silage. Silage can also prepared from legumes after mixing with cereal fodders as mixed silage. Certain island abundant plants/shrubs like sea weeds and touch me not (*Mimosa Pudica*) can also be used to utilize this technology.

l) **Arecanut:** The fallen areca sheath is available throughout the year in the islands. Areca sheath, as an alternate resource, has been evaluated for use as a fodder by several governmental and private agencies. To prepare 2 kg cattle feed take 1.5 kg shredded areca sheath (2cm X 1-2 cm) soaked in warm water for 1-2 h or cooked for 30 min and

mixed with 500g grain (wheat, rice or any cereal) can be fed after cooling.

m) **Azolla cultivation and production units**

Azolla (*Azolla* sp.) is an aquatic (duckweed) fern consisting of a short, branched, floating stem, bearing roots which hang down in the water. An area of 4-4.5 m² and 10-15 cm deep can produce about 2 kg/d of fresh azolla, enough to supplement 2 dairy cows. Azolla has crude protein (CP) of approx. 21% on dry matter basis and dry matter of 6-7%. Azolla can be supplementary feed not a primary feed for the animals, as 1 kg fresh Azolla will have CP of 12.6-14.7g. It needs humidity more than 60% and shady area.

n) **Establishment of Silvi-Pasture System**

Silvopasture is the practice of integrating trees, forage, and the grazing of domesticated animals in a mutually beneficial way in same land with principles of managed grazing. Properly-managed silvi-pasture can increase overall productivity and long-term income due to the simultaneous production of tree crops, forage, and livestock, and can provide environmental benefits such as carbon sequestration. Silvi-pasture is one of the oldest known forms of agriculture, and has been practiced in many parts of the world for centuries. Livestock production component in silvi-pasture system creates a stable source of cash flow prior to timber harvest and diversifies the forestry enterprise. Nitrogen-fixing forage species, pasture fertilization and animal manure all component help improve the soil and tree nutrition. Grazing controls competing brushy species and competition between trees is less at the wider spacing employed with silvi-pasture, resulting in greater timber yield. Trees create a sheltered microclimate to protect animals from heat and cold. Shelter also improves forage quality and lengthens its growing season. The prunings/cuttings of some trees can also be used as fodder to support better livestock growth.

o) **Selective rearing of livestock**

The topography of the bay islands can be better described as long range of hills in the sea stretched from north to south. These islands are commonly hilly and rippling and the flat islands are relatively less in number, making them suitable for plantation crops and livestock rearing. The shortage of grazing land and fodders indirectly compels to rear small animals like goats, pigs, rabbits, chickens (broilers and layers) and Japanese quail, which are very good venture for these islands.

Goat, poor man's cow supports economy and nutrition of poor and marginal rural farmers and act as source of additional income and insurance against disaster. Goats are hardy animals and can thrive on shrubs and trees in adverse harsh environment in low fertile lands where no other crops can be grown. The additional advantages of goat farming are like, require low initial investment and less management, best suited animals for feed scarce areas, highly prolific (triplets and quadruplets kidding), fast sexual maturity (12 m) and more importantly has no religious taboo.

Pig meat (pork) and poultry meat have huge demand in the islands. To meet out the pork demand semi-intensive and intensive piggery is a good option. The pig has highest feed conversion efficiency and thus best converter of grains, forages, damaged feeds and garbage into nutritious meat. Piggery is very beneficial as pig can utilize wide variety of feed stuffs, prolific with shorter generation interval (12, average litter size and sow can be bred at 8-9m age), requires less initial investment (building and equipments'), high dressing percentage (65-80%), manure can be utilized as bio-fertilizer and pigs are

always instant money (piglets or pigs can be sold any time).

Backyard poultry is like culture in the rural Andaman households but, commercial poultry need a boost to meet-out the market demand. More suppliers of broilers chicks are needed and more awareness about the poultry farming necessitate for the islands. Quails are very hardy birds (after 2 weeks of age) and several diseases resistant. Quail require less space ($1/6^{th}$ of chicken) and less expensive to start with. Quails can be sold after 30 days and starts laying at 7 week for 280 eggs in a year. Moreover, quail meat is more acceptable (opines to have nutraceutical properties) in the islands and are more tasty than chicken.

Rabbit farming can be very good venture for the interested farmers. Rabbits are very fast growing animal. Consume forages of diverse origins and food converting rate is very good. One female rabbit can produce 2 to 8 bunny (young one) per birth. Production costs are less, and require very less space. Main problem in Rabbit farming in the islands is marketing and islanders are not familiar with the meat, thus advertisement and awareness creation is obligation.

p) **Integrated Farming System (IFS)**

IFS practice meant for all-round development of agriculture with animal husbandry and other components related to core agricultural practices. The islanders posses land holdings, a suitable IFS model can enhance sustainability and decrease the input cost and increase the profit of the farmer. In the IFS, the products or the by-products of one component act as input for other, thus require very less outside input for the system. Rice-goat-vegetable-chicken/duck-fish IFS model can do wonder in the island. In rice cultivating areas, straw can act as the feed for the cattle or buffaloes. Goat droppings can be used as bio-fertilizer or vermi-compost can be prepared. The poultry dropping can be used as livestock feed (dropping and feather meal), fish feed or vermin-compost. Fish can be sold in market or fish meal can be of good protein source for the goats. The vegetables can be used by household, surplus sold at market and the waste can be fed to poultry/fishes. The land can be fertilized by the compost or vermi-compost prepared out of droppings of poultry and goats.

Conclusion

The islanders have many problems in animal rearing, which can be curbed by a combined effort of ICAR-CIARI, KVKs and the line departments (Agriculture and Animal Husbandry Depts.) of the island administration. The islanders are indifferent and unaware of many aspects of scientific animal rearing, thus there is need to impart awareness campaign, training, practical field demonstration on technical knowledge and knowhow of the animal production and modern rearing system. Our islands need a breeding policy, fodder policy, island special package of practices for all the animals and birds, fodder banks, implementation of neo-fodder production and preservation technologies (viz.Azolla, Hydroponics) and old practices (but, new to the islands, viz., urea/ ammoniation of the straw, CFB, etc.) to be implemented, where Scientist/experts of Animal Nutrition, Breeder and Production & management can play a pivotal role. It is required to apply new feeding practices, mineral and balanced ration feeding, precise nutrition (the best animal feeding strategy), special feeding (young, pregnant and lactating animals) pellet feeding and integrated farming system (best farming system for islands) and silvi-pasture system.

There is dire need of fodders for animals and birds; moreover the islands are declared organic which emphasizes more requirements of fodders. Thus, fodder production can be increased in the islands by introducing island friendly high yielding varieties, increase use of fallow land, intercropping, using unconventional fodders (areca-sheath, tree leaves, abundant edible weeds and

leafy veggies), silvi-pasture system and encouraging large land-holder farmer to opt fodder production as business. Moreover, the governmental agencies like ICAR-CIARI, KVKs and the line departments (Agriculture and Animal Husbandry Depts. and Disaster Management Agency) of the island administration can take up preparation of Fodder reserves and Complete Feed Blocks for instant or future use. Finally some efforts are also invited from the farmers in terms of better rearing practices, such as feeding chaffed fodder, feeding balanced ration, feeding mineral mixture, de-worming and if possible feeding the bird or the animal according to the need (precise nutrition). Thus, livestock production can only be sustained and can be a profitable venture if these challenges are curbed.

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Received : 07th August, 2018 Accepted : 16th January, 2019