



सत्यमेव जयते

Empowerment of Women Farmers in Sundarban

Funded By
Department of Biotechnology,
Ministry of Science
& Technology,
Govt. of India



Bio-Tech KISAN Hub
Directorate of Research, Extension and Farms
West Bengal University of Animal and Fishery Sciences

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West Bengal University of Animal & Fishery Sciences
Kolkata – 700037, West Bengal

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West Bengal University of Animal and Fishery Sciences, Kolkata

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শ্রী স্বপন দেবনাথ

ভারপ্রাপ্ত মন্ত্রী

প্রাণী সম্পদ বিকাশ বিভাগ

পশ্চিমবঙ্গ সরকার

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E-mail : wbmosard@gmail.com



Sri Swapan Debnath

Minister -in-Charge

Animal Resources Development Department

Government of West Bengal.

Prani Sampad Bhavan (4th floor)

LB-II, Sector - III, Salt Lake

Kolkata - 700 106

Telefax : (033) 2335-1130

(033) 2335 -1130/1144

E-mail : wbmosard@gmail.com

MESSAGE



I am very much glad to know that the prestigious project, "Establishment of Biotech-KISAN Hub", at the West Bengal University of Animal and Fisheries Sciences in Kolkata has met the key goals of the project towards the enrichment of livelihood of the farming community of West Bengal especially livestock and fish farmers which is the greatest success of the project.

I take the opportunity to heartily congratulate all the women farmers whose stories have been presented here. Their pioneering efforts would encourage the women and rural youth to consider the livestock and aquaculture as their

financial security. Bio Tech KISAN Hub has taken its endeavor for women empowerment by increasing their income through creation of small-scale enterprise and considerable economic gain in terms annual income is considered to be a remarkable achievement and praise worthy.

On the eve of the publication of 'Empowerment of Women Farmers in Sundarban', I express my best wishes to concerned wing of the University who are making untiring efforts to bring a smile in face of the livestock and fish farmers. The fruitful implementation of the project in the way for women's empowerment by increasing their family income will be a yardstick programme of University.

Swapan Debnath
01.06.2021
Sri Swapan Debnath



सत्यमेव जयते

डॉ. रेणु स्वरूप
DR. RENU SWARUP



सचिव
भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
जैव प्रौद्योगिकी विभाग
ब्लॉक-2, 7वां तल, सी० जी० ओ० काम्पलेक्स
लोधी रोड, नई दिल्ली-110003
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
Block-2, 7th Floor, C.G.O. Complex
Lodhi Road, New Delhi-110003


MESSAGE

The Department of Biotechnology lays major emphasis on generation of Biotech products, processes and technologies for enhanced efficiency, productivity and cost-effectiveness in the areas of agriculture, food and nutritional security, affordable healthcare and wellness, environmental safety, clean energy, bio-fuel, bio-manufacturing etc.

It becomes imperative to bring self-sufficiency in the livestock, poultry and fishery production and ensuring nutritional security of common mass. Black Bengal Goat and Garole Sheep are a significant contributor to the economy as well as the socio-economic fabric of the country, especially in the state of West Bengal. The Department of Biotechnology, Ministry of Science & Technology, Government of India recognizing its importance supported activities for entrepreneurship development through livestock, especially Black Bengal Goat and Garole Sheep in difficult to reach areas of Sundarbans of West Bengal under the Biotech-KISAN Hub at West Bengal University of Animal & Fishery Sciences, Kolkata.

I am happy to lean that the University has made a lot of effort to popularize modern know-how of scientific sheep and goat rearing practices among rural farm women in Sundarban area. The elite Germplasm Centre for sheep and goat having an annual production capacity of 500 kids/lambs has been established at Sundarbans. A total of 4,224 farmers, including over 1,000 women farmers of the remote islands of Sundarbans have been benefited by adopting modern know-how of scientific sheep and goat rearing practices. The creation of considerable number of Farmers' Producer Organization (FPO) has also helped in procuring inputs and selling the produce at right price in Sundarban area.

My good wishes to the Vice-Chancellor, West Bengal University of Animal & Fishery Sciences, Kolkata and his team for successfully implementing the project. We hope that the University, in association with Department of Animal Resources Development, Govt. of West Bengal will cover a large number of farmers in other remote areas of the Island to improve socio-economic conditions of the resource-poor Islanders of Sundarbans.


(Renu Swarup)



WEST BENGAL UNIVERSITY OF ANIMAL AND FISHERY SCIENCES

68, Kshudiram Bose Sarani, Belgachia, Kolkata - 700037
Phone : 2556 3450, (M) : 9433149638, Fax : 91-33-2557-1986
Web : www.wbuafsci.ac.in, E-mail : vcwbuafs@gmail.com

Prof. Chanchal Guha, Ph.D.
Vice-Chancellor

No. VCS/WBUAFS/.....
Date :

Foreword



The innovative project on “Establishment of Biotech-KISAN Hub” at West Bengal University of Animal and Fisheries Sciences, Kolkata has been successful in achieving all its objectives and has produced the first improved earning system in the region. The livestock particularly small ruminants are significant contributors to the economy as well as the socio-economic fabric of the country for boosting farmers’ income. Vaccination along with complete health coverage, balanced feeding and scientific management under this programme were created livelihood security of the small and marginal farmers especially women farmers of the remote area of

Sundarban through Improved of Black Bengal Goat and Garole Sheep.

I am very much pleased that the entire team has been doing serious work for the rural stakeholders even in this COVID 19 pandemic situation. I am also apprised of the endeavor to include a considerable number of migrant laborers who have lost their job due to COVID 19 pandemic under the project to help them by effective entrepreneurship development through improved sheep and goat husbandry practices.

The fruitful implementation of the project and publication the present bulletin entitled ‘Empowerment of Women Farmers in Sundarban’ will certainly creates the way for women's empowerment by increasing their family income will be a yardstick programme which can followed in future. I express my sincere thanks to DBT, Govt. of India for extending all sorts of support for implementing such a wonderful programme.

(PROF. CHANCHAL GUHA)

Acknowledgements

I express my sincere gratitude to all farmers of Sundarban of West Bengal who have actively participated in the Biotech-KISAN (Krishi Innovation Science Application Network) Project dealing with mainstreaming the farming of small ruminants especially Garole Sheep and Black Bengal Goat, the pride of the State.

I acknowledge the guidance received from Prof Chanchal Guha, Vice-Chancellor WBUAFS through sparing his valued time for monitoring the progress of the project on regular basis. I extend my thanks to Prof B K Das Director of Research, Extension and Farms, WBUAFS, Finance Officer, WBUAFS and Dr Sourav Chandra, Registrar, WBUAFS for their constant support towards the successful implementation of the project. The authors express their deep sense of gratitude for all-out support extended by Prof. Arunasis Goswami, Professor, Dept of Veterinary and Animal Husbandry Extension Education and Former Director of Research, Extension and Farms, West Bengal University of Animal and Fishery Sciences in implementation of the project. I am really thankful to Prof Subhasish Biswas, Ex Director of Research, Extension and Farms for his guidance helping immensely in attaining the objectives of the project. I express my deep sense of gratitude to the authorities of the partner Institutes.

I deeply acknowledge generous funding and support received from the Department of Biotechnology, Ministry of Science & Technology, Government of India for this Biotech-KISAN Hub Project. I express my profound deep sense of gratitude to the encouragement and support received from Dr Renu Swarup, Secretary, Department of Biotechnology, Ministry of Science & Technology, Government of India for successfully implementing this project. I am also extremely grateful to Dr. Mohd. Aslam former Advisor (Scientist 'G'), Department of Biotechnology, Ministry of Science & Technology, Govt. of India, Smt. Radha Ashrit, Statistical Advisor, DBT and Dr. Vaishali Panjabi, Scientist 'E', DBT, Ministry of Science & Technology, Govt. of India for their meticulous guidance to execute this farmer-friendly project.

I am indebted to Dr H S Gupta, Chairman of the Project Steering and Monitoring Committee for his untiring interest and endless encouragement. I deeply acknowledge the constant guidance received from Prof. Gaya Prasad, Identified Mentor of Biotech KISAN, WBUAFS and Former Vice-Chancellor, SVBPUAT, Meerut, UP

I am also grateful to all my colleagues of WBUAFS, all the Co-Principal Investigators, Project staff and other supportive Staff for their active support for implementing this project.

Keshab Chandra Dhara

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Acronyms & Abbreviations

WBUAFS	West Bengal University of Animal and Fishery Science
Biotech	Biotechnology
DBT	Department of Biotechnology
FIG	Farmers Interest Group
FPO	Farmers' Producer Organization
FY	Financial Year
KISAN	Krishi Innovation Science Application Network
Kg	Kilogram
KVK	Krishi Vigyan Kendra
PSMC	Project Steering and Monitoring Committee
SEM	Standard Error Mean
S&T	Science and Technology
VC	Vice-Chancellor

Executive Summary

Biotech-KISAN Programme of the Department of Biotechnology attempts to link the available knowledge and technology with the farmers based on understanding their problems and possible solution for improving their livelihood. The present project was implemented in Sundarban area through West Bengal University of Animal and Fishery Sciences during 2018-20. To begin with an elite Germplasm centre for sheep and goat was established at Mohanpur with 229 Garole sheep and 366 Black Bengal goats purchased from the farmers of Sundarban with an annual production capacity of 500 kids/lambs. A total of 4,224 farmers of the project site got benefitted from the project in the area. Selection of 1,000 women farmers based on the survey of 5,998 sheep and goat farmers of Gosaba, Basanti (South 24 Paragana), Hingalganj (North 24 Paragana) block of Sundarban was done and out of them, 852 farm women were trained on modern know-how of scientific sheep and goat rearing practices. The output of the training in terms of knowledge gain was an average of 76%. In order to bring about empowerment of the women farmers through scientific sheep and goat rearing, 850 quality Garole sheep and Black Bengal goat kids produced at the Germplasm Centre (out of which 150 were male which will help in multiplication of quality sheep and goat population in this Island) of the age of 8-10 months were distributed among 425 trained Women Farmers of Sundarban. Apart from this, quality feed (for goat and sheep) and region-specific mineral mixture was also distributed along with complete health care package of practices. An average economic gain of 48% (Average annual income gain is Rs 32,000/-) in annual family income along with an increase in the population strength of sheep and goat to the tune of 141.57% among the selected beneficiaries was recorded. It was observed that overall increase in the population strength of the small ruminants was 36.36% in the project area which was due to the impact of the project. Enhancement in the income of the farmers was observed through the sale of sheep and goats which is considered to be a success of adoption of superior quality small ruminants through this project. Value addition of the meat helped in further increasing income of the farmers through marketing of the value added meat products like meatball and sausage apart from processed skin. The formation of FPOs has also ensured better and consistent market price of their sheep and goats.

1 | Introduction

The Sundarban, a large delta created by the three great rivers; the Ganges, the Brahmaputra and the Meghna spread over part of India and Bangladesh, covers around 25,500 K.M² areas. The Indian part of the Sunderban is approximately 9,630 KM² and is not confined to one single district. It covers 6 administrative blocks of North 24 Paragana and 13 blocks in South 24 Paragana districts. In the island blocks of Sundarban, very limited earning opportunities exist and therefore, a large percentage of households depend on their non-viable marginal land. Livestock sector, particularly the valuable genetic resource of sheep and goat known as “Garole Sheep” and “Black Bengal Goat”, respectively, play a vital role in the economy through marketable commodities such as meat, milk, fibre and skin. As sheep and goats are smaller in size, their management can be easily done by the women farmer; therefore, such practice is preferred for income of the rural community compared to farming of other livestock species. The goats and sheep rearing substantially contribute to fulfill the needs of the women farmers and their family members. In view of the above, efforts were made to safeguard the interest of these islanders by providing a sub alternative solution for their improved livelihood. Improvement of the farming of the sheep and goats through Biotech KISAN Hub has helped them in securing their livelihood which is the motto of the project. Since Sheep and goats are an integral part of the farmers in the village Bali 1, Bali 2, Choto Mollakhali, Jharkhali, Tridibnagar, Laskapur, Sahebkhali, Ramapur, Charalkhali, Moukhali, Deuli of Surdarban area were included in DBT-funded project entitled ‘Establishment of Biotech KISAN Hub at West Bengal University of Animal & Fishery Sciences’ to help the local farmers especially women farmers to improve their livelihood.

AGRO-CLIMATIC ZONE: Lower Gangetic Plains Region

2 | Establishment of Germplasm Centre

Establishment of a clean Germplasm center is a pre-requisite for distribution of healthy kids/lambs to the selected farmers. Therefore, disease free and superior quality Garole sheep (229) and Black Bengal goats (366) based on their typical phenotypic characters and pedigree history were selected from the farmers' field of Sundarban. Preference was given to twin and triplet born does and lambs. The establishment of Germplasm centre at Mohanpur was started with these selected animals in the year 2018. The present annual capacity of production of this centre is more than 500 kids/lambs per year. The distribution of 850 healthy and best quality animals (200 Garole sheep and 650 Black Bengal goats) among the 425 Women farmers of Sundarban was done from this stock of which 100 and 50 were bucks and rams, respectively. Presently, 186 Garole sheep and 168 Black Bengal goats are being maintained in this Germplasm centre. Twenty Garole sheep and 10 Black Bengal goats have been culled and sold out through auction. Total financial output from the centre is about Rs 13,58,200/- as per local market price (the cost of distributed animals and existing stock has been included where as the expenditure of purchasing stocks and feeding them has been excluded). The reproductive and productive performances of the stock are satisfactory. The sheep breeding farm at Mohanpur is probably the only organized Garole sheep farm in the country apart from Central Sheep and Wool Research Institute, Avikanagar, Rajasthan. This is considered as a remarkable success of the project. All these animals are reared under the semi-intensive system of management maintaining suitable prophylactic practices and proper herd records.

2.1 Performances of Black Bengal Goat

A total of 380 of Black Bengal kids were born in the Germplasm centre. On the basis of the record of these kids, their productive (Table 1) and reproductive performances (Table 2) have been assessed as per the standard practice. The comparative study of their year of birth and generation did not show significant effect on body weight gain or body height, chest girth and body length of Black Bengal goat in different age groups. It has been observed that the body weight of male kids (1.350 ± 0.023 kg) was significantly ($p < 0.01$) higher than the female kids (1.262 ± 0.018 kg) at birth and similarly, the body weight at three months age of male kids (5.538 ± 0.197 kg) was significantly ($p < 0.05$) higher than the female kids (5.150 ± 0.155 kg). The effect of sex on body weight at 6 months was also found significant ($p < 0.05$) and the males (8.843 ± 0.244 kg) were significantly heavier than the females (8.335 ± 0.192 kg) where as at 9 months of age there was no significant difference in body weight of male (11.790 ± 0.273 kg) and females (11.344 ± 0.215 kg). The birth weight of triplet and above (1.194 ± 0.024 kg) and twins (1.199 ± 0.020 kg) were significantly ($p < 0.01$) lower than singlet (1.311 ± 0.020 kg). Similarly, the body weight at three months and six months age of triplet and above (5.282 ± 0.210 and 7.858 ± 0.260 kg) were significantly ($p < 0.05$) lower than the twin (5.59 ± 0.174 kg and 8.884 ± 0.216 kg) and similarly was significantly ($p < 0.05$) lower than singlet (5.69 ± 0.170 kg and 9.172

± 0.210 kg). The effect of birth type on weight was not significant at 9 months of age. The birth weight of the kid born in Summer (1.35 ± 0.01 kg) was significantly ($p < 0.01$) higher than those born in the rainy season 1.35 ± 0.01 kg) and Winter (1.29 ± 0.02 kg) while the body weights at 3, 6 and 9 months of the kids born in the different season showed no significant differences.

Reproductive data (Table 2) based on (i) age at first mating, (ii) weight at first mating, (iii) age at first kidding, (iv) service per conception, (v) weight at first kidding, (vi) gestation period, (vii) service period (viii) kidding interval of 240 Black Bengal does for the year 2018 to 20 (up to March 2020) reared in the Germplasm centre at Mohanpur was analyzed. The observed result of the overall average age at puberty was 202.82 ± 8.54 days, age at first conception was 232.96 ± 5.44 days, and age at first kidding was 392.25 ± 7.48 days, average weight at 1st kidding was 13.74 ± 2.2 kg, the gestation period was 144.99 ± 2.32 days. The average litter size was observed as 1.58 ± 0.32 and the average litter weight was 1.96 ± 0.54 kg. The usual numbers of kids born at one time in Black Bengal goats varied from single to quadruplet. The Age of kid mortality was more in first parity under one month of age higher but gradually declined with the age of kids. The kid mortality decreased from 21% to 2% with the increase of parity.

Table 1: Least Square Mean and SEM of Body Weight (Kg) of Black Bengal Goats at Different Ages

Factor	Body Weight			
	Birth	3 Months	6 Months	9 Months
Overall Mean	1.304 ± 0.014 (380)	5.492 ± 0.124 (380)	8.577 ± 0.154 (380)	11.556 ± 0.172 (380)
2018-19	1.308 ± 0.023 (58)	5.433 ± 0.198 (58)	8.405 ± 0.244 (58)	11.761 ± 0.274 (58)
2019-20	1.302 ± 0.018 (322)	5.475 ± 0.155 (322)	8.486 ± 0.192 (322)	11.474 ± 0.214 (322)
Male	1.350 ± 0.023^a (134)	5.53 ± 0.197^a (134)	8.843 ± 0.244^a (134)	11.790 ± 0.273 (134)
Female	1.262 ± 0.018^b (246)	5.150 ± 0.15^b (246)	8.335 ± 0.192^b (246)	11.344 ± 0.215 (246)
Single	1.311 ± 0.020^a (80)	5.69 ± 0.170^a (80)	9.172 ± 0.210^a (80)	12.08 ± 0.235 (80)
Twin	1.199 ± 0.020^b (222)	5.59 ± 0.174^b (222)	8.884 ± 0.216^b (222)	12.053 ± 0.242 (222)
Triplet and above	1.194 ± 0.024^b (78)	5.282 ± 0.210^c (78)	7.858 ± 0.260^c (78)	11.226 ± 0.291 (78)
1 st Generarion	1.308 ± 0.017 (305)	5.541 ± 0.152 (305)	8.732 ± 0.188 (305)	11.612 ± 0.210 (305)
2 nd Generation and above	1.304 ± 0.023 (75)	5.56 ± 0.019 (75)	8.96 ± 0.244 (75)	11.676 ± 0.273 (75)
Summer	1.35 ± 0.01^a (122)	5.55 ± 0.12 (122)	8.88 ± 0.17 (122)	11.94 ± 0.18 (122)
Rainy	1.26 ± 0.01^b (178)	5.52 ± 0.10 (178)	8.79 ± 0.13 (178)	11.86 ± 0.14 (178)
Winter	1.29 ± 0.02^b (80)	5.51 ± 0.16 (80)	8.73 ± 0.18 (80)	11.89 ± 0.19 (80)

Values in parenthesis are number of observations and means with different superscripts between columns with in row differed significantly.

Table 2: Least Square Mean and SEM of the Reproductive Traits of Black Bengal Goats

Reproductive trait	Mean \pm SEM		
	2018-19	2019-20	Overall
Age at first service (days)	220 \pm 2.43 (40)	233.25 \pm 1.32 (200)	232.96 \pm 5.44 (240)
Weight at first service (Kg)	9.98 \pm 1.14 (40)	10.14 \pm 0.06 (200)	10.10 \pm 0.46 (240)
Age at first kidding (days)	366 \pm 2.41(40)	401.95 \pm 1.64 (200)	392.25 \pm 7.48 (240)
Service per conception (no.)	1.29 \pm 0.04 (40)	1.22 \pm 0.02 (200)	1.26 \pm 0.51(240)
Weight at first kidding (kg)	13.12 \pm 0.74 (40)	14.12 \pm 0.11 (200)	13.74 \pm 2.2 (240)
Gestation period (days)	145 \pm 0.41 (40)	144.98 \pm 0.49 (200)	144.99 \pm 2.32(240)
Service period (days)	----	59.92 \pm 0.55 (65)	59.92 \pm 0.55 (65)
Kidding Interval (days)	---	204.89 \pm 0.70(65)	204.89 \pm 0.70(65)

2.2 Performances of Garole Sheep

A total of 293 Garole sheep were born in the Germplasm centre. On the basis of the record of these animals, their productive (Table 3) and reproductive performances (Table 4) have been assessed as per the standard practice. The comparative study of their year of birth and generation does not show any significant effect on body weight or body height, chest girth and body length of Garole sheep in different age groups. It has been observed that the body weight of male lamb (1.126 ± 0.022 kg) was significantly ($p < 0.01$) higher than the female lamb (1.089 ± 0.018 kg) at birth and also the body weight at three months age of male lambs (5.073 ± 0.223 kg) was significantly ($p < 0.05$) higher than the female lambs (4.724 ± 0.183 kg). The effect of sex on body weight at 6 and 9 months of age was found to be non-significant however, the males (7.322 ± 0.273 kg and 10.297 ± 0.357 kg) were slightly heavier than the females (7.302 ± 0.273 kg and 10.175 ± 0.294 kg).

The birth weight of triplets and above (1.023 ± 0.23 kg) along with twins (1.029 ± 0.021 kg) was significantly ($p < 0.05$) lower than the singlets (1.104 ± 0.032 kg). The body weight at 3, 6 and 9 months of age of different birth types was not significant. The birth weight of the lamb born in Summer (1.15 ± 0.011 kg) was significantly ($p < 0.01$) higher than those born in the Rainy season (1.07 ± 0.012 kg) and Winter (1.09 ± 0.016 kg) while the body weight at 3, 6 and 9 months of the lambs born in different seasons were recorded without any significant changes.

Reproductive data based on (i) age at first mating, (ii) weight at first mating, (iii) age at first Lambing, (iv) service per conception, (v) weight at first lambing, (vi) gestation period, (vii) service period (viii) lambing interval of 176 Garole ewes for the year 2018 to 20 (up to March 2020) reared in the Germplasm centre at Mohanpur has been calculated. The observed result of overall average age at puberty was 201.84 ± 3.44 days, age at first conception was 236.96 ± 5.54 days, age at first lambing was 383.25 ± 6.78 days, average weight at 1st lambing is 14.14 ± 4.12 kg, the gestation period was 145.14 ± 0.38 days. The average litter size was observed as 1.67 ± 0.58 and average litter weight was 1.87 ± 0.75 kg. The usual number of lambs born at one time in Garole sheep varied from singlet to quadruplet.

Table 3: Least Square Mean and SEM of Body Weight (Kg) Garole Sheep at Different ages

	Birth	3 Months	6 Months	9 Months
Overall Mean	1.104 ± 0.014 (293)	4.930 ± 0.141 (293)	7.802 ± 0.173 (293)	10.757 ± 0.227 (293)
2018-19	0.998 ± 0.031 (26)	4.857 ± 0.309 (26)	8.150 ± 0.379 (26)	10.423 ± 0.496 (26)
2019-20	1.114 ± 0.013 (267)	5.133 ± 0.135 (267)	8.175 ± 0.165 (267)	10.948 ± 0.216 (267)
Male	1.126 ± 0.022 ^a (72)	5.073 ± 0.23 ^a (72)	7.322 ± 0.273 (72)	10.297 ± 0.357 (72)
Female	1.089 ± 0.018 ^b (221)	4.724 ± 0.18 ^b (221)	7.302 ± 0.273 (221)	10.175 ± 0.294 (221)
Single	1.104 ± 0.032 ^a (49)	4.851 ± 0.327 (49)	7.549 ± 0.401 (49)	10.354 ± 0.525 (49)
Twin	1.029 ± 0.021 ^b (175)	4.806 ± 0.207 (175)	7.418 ± 0.0254 (175)	10.814 ± 0.333 (175)
Triplet and above	1.023 ± 0.23 ^b (69)	4.798 ± 0.231 (69)	7.415 ± 0.284 (69)	10.75 ± 0.371 (69)
1 st Generation	1.116 ± 0.018 (188)	4.710 ± 0.181 (188)	7.446 ± 0.221 (188)	10.136 ± 0.290 (188)
2 nd Generation and above	1.090 ± 0.022 (105)	5.195 ± 0.223 (105)	8.230 ± 0.273 (105)	11.502 ± 0.358 (105)
Summer	1.15 ± 0.011 ^a (94)	4.72 ± 0.22 (94)	7.55 ± 0.404 (94)	10.15 ± 0.672 (94)
Rainy	1.07 ± 0.012 ^b (137)	4.69 ± 0.29 (137)	7.47 ± 0.342 (137)	10.08 ± 0.614 (137)
Winter	1.09 ± 0.016 ^b (62)	4.68 ± 0.23 (62)	7.42 ± 0.573 (62)	10.10 ± 0.925 (62)

Values in parenthesis are number of observations and means with different superscripts between columns with in row differed significantly.

Table4: Least Square Mean anadem of the Reproductive Traits of Garole Sheep

Reproductive trait	Mean ± SEM		
	2018-19	2019-20	Overall
Age at first service (days)	237 ± 4.10(18)	236.46 ± 1.35 (158)	236.96 ± 5.54 (176)
Weight at first service (Kg)	10.18 ± 1.14 (18)	10.13 ± 0.78(158)	10.16 ± 0.95 (176)
Age at first lambing (days)	383.12 ± 2.88(18)	383.55 ± 1.53(158)	383.25 ± 6.78 (176)
Service per conception (no.)	1.29 ± 0.04 (18)	1.16 ± 0.22(158)	1.23 ± 1.21(176)
Weight at first lambing (kg)	14.22 ± 0.74 (18)	14.12 ± 0.12(158)	14.14 ± 4.12 (176)
Gestation period (days)	145.13 ± 0.41 (18)	145.14 ± 0.60(158)	145.14 ± 0.38(176)
Service period (days)	---	60.00 ± 0.65 (54)	60.00 ± 0.65 (54)
Lambing interval (days)	---	205.17 ± 0.83(54)	205.17 ± 0.83(54)



Black Bengal doe with four kids in Germplasm



Garole ewe with five Lambs in Germplasm Centre

3 | Technological Package of Practices

FRONT LINE DEMONSTRATION

1. Application of region specific Mineral Mixture supplementations
2. Deworming with specific Anthelmintics
3. Feeding of Concentrate Mixture and Azolla feeding
4. Proper Housing and Management
5. Cultivation of Green Fodder
6. Vaccination of Goats against PPR
7. Vaccination of Goats against Goat Pox
8. Vaccination of Garole Sheep against Sheep Pox
9. Adoption of Superior quality Germplasm of Black Bengal Goat
10. Adoption of Superior quality Germplasm of Garole Sheep
11. Value Addition in Meat Products

3.1. Application of Region-Specific Mineral Mixture Supplementation

Minerals play an essential role in physiological maturation like growth, health, reproduction and also help in normal physiological functions of animal's body. The supplementation of Area Specific Mineral Mixture (ASMM) has increased their reproductive and productive efficiency.

3.2. Deworming with specific Anthelmintics

Deworming is one of the most important management practices, which minimizes the parasitic load and results in better health of goats and sheep. The deworming practice also reduces the cost of medicine which leads to better economic returns to the farm women. Through effective implementation of Bio-Tech KISAN Hub, WBUAFS has been helping women farmers of Sundarban by guiding as well as providing anthelmintics to them for deworming and also providing them package of practices to adopt scientific goat and sheep rearing.

3.3. Feeding of Concentrate Mixture and Azolla

In goat rearing, 70% of the total cost is for the feeding of animals. To get better economic returns, the goat farmers have been trained to prepare goat feed from unconventional and cheaper feed ingredients. Feeding of concentrate mixture and azolla have been found most effective in reducing the feed cost. By adopting this practice, the goat farmers of Sunderban got better economical returns.

3.4. Proper Housing and Management

Proper scientific housing and management practices along with their advantages have been demonstrated to the sheep and goat farmers of Sundarbans bio-Tech KISAN Hub, WBUAFS. Fortunately farm women of Sundarban have widely accepted the practices and therefore the animals are getting better and healthy life which in turn has effectively reduced the medical expenditure resulting higher economic benefits.

3.5. Cultivation of Green fodder

Consumption of green fodder helps to provide sufficient nutrition to their animals and reduces feed cost. Farm women of Sundarban have been trained in cultivation of green fodders viz. Jowar and hybrid Napier grass which they adopt successfully.

3.6. Vaccination of Goat against PPR

The farmers of Sundarban have been trained and are aware about scheduled vaccination against PPR. This helps to reduce mortality rate of goat as well as helps to increase the income from goat rearing. Bio-Tech KISAN Hub, WBUAFS also provides vaccine to them to their door step through organizing animal health camp.

3.7. Vaccination of Goat against Goat Pox

Like goat PPR vaccine, goat pox vaccine was also provided to them. In one way this activity helps to reduce mortality rate of goat and on the other hand it helps them to adopt scientific rearing practices.

3.8. Vaccination for Garole Sheep against Sheep Pox

Vaccination of Garole sheep against Sheep Pox was also done by Bio-Tech KISAN Hub, WBUAFS to support the farmers and encourage them in sheep rearing in a scientific way.

3.9. Adoption of Superior quality Germplasm of Black Bengal Goat

Adoption of Superior quality Germplasm of Black Bengal Goat by farmers of Sundarban is another success for Bio-Tech KISAN Hub, WBUAFS. This helps them to get superior quality of goat which in turn increases the market value of their products.

3.10. Adoption of Superior quality Germplasm of Garole Sheep

Like Black Bengal goat, adoption of superior quality of Garole sheep from Germplasm Center of Bio-Tech KISAN Hub, WBUAFS among farmers of Sundarban, is another glorious success of establishment of Germplasm center.

3.11. Value Addition in Meat Products

Value additions of edible meat products and market tie-up have been made. Farmers have been organized into small neighborhood in formal groups which are being supported under the programme. Business operations like the commencement of procurement, production, processing, marketing and financial service activities of an FPO positively lead an effective entrepreneurship among these farm women who are the beneficiaries of Biotech KISAN Hub. Capacity building on value addition of meat products has created more income by way of marketing of value-added meat products like meatball and sausage apart from processed skin.



Women farmers recording temperature of Goat and making management during lambing.

4 | Training and Skill up gradation of Women Farmers

Twenty-two formal training programme for farm women with suitable and technologically advanced curriculum have been organized for the selected beneficiaries under DBT mission mode programme on Establishment of Biotech-KISAN Hub at WBUAFS, Kolkata. The training programmes were conducted for effective capacity building of the farm women towards their livelihood security. A total of 852 farm women were trained on scientific small ruminants rearing. Hands-on training on scientific management practices, vaccination, first aid treatment and preparation of value-added meat products in remote areas. An assessment of the effectiveness of these training programmes reveals a tremendously remarkable impact on the adoption of the scientific method of sheep and goat rearing practices by the farm women of Sundarban. A number of such trained and efficient women force is being considered a key success to the programme as they are taking a pivotal role in poverty alleviation in these islands. The impact of training with respect to knowledge gain has been assessed and it was found that the overall knowledge gain was about 76.19% and all these factors cumulatively have a significant effect in increasing knowledge level among these farm women after their exposure to the training (Table 5). In general, it was also observed that most of the farm women were fully satisfied with the major instructors (75.9%), relevance to the trainee's need (68.40%) and the programme in general (60.1%).

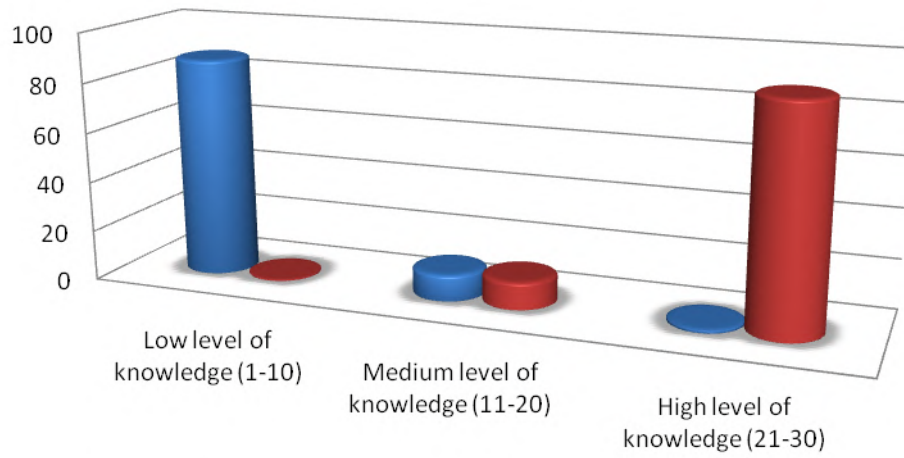
Table: 5: Farm Women's Knowledge Scores at Pre-and Post-Training Programme

Sl. No	Parameters	Mean knowledge score		Mean knowledge gain score	Percentage of knowledge gain
		Before training	After training		
1.	Housing management	5.95 ± 0.84	22.8 ± 1.84**	16.85	73.90
2.	Breeds & breeding practices	7.04 ± 1.02	23.7 ± 2.14**	16.66	70.30
3.	Feeding practices	4.31 ± 0.75	20.1 ± 2.78**	15.79	78.56
4.	Fodder production	5.22 ± 0.95	16.5 ± 3.28**	11.28	68.36
5.	General care & management	2.88 ± 0.55	22.4 ± 5.33**	19.52	87.14
6.	Health care management	4.75 ± 0.66	22.5 ± 2.28**	17.75	78.89
7.	Overall	5.025 ± 0.75	21.33 ± 3.25**	16.31	76.19

** Highly Significant at P<0.01

A significant increase in overall adoption percentage of scientific sheep and goat rearing practices by the rural farm women of Sundarban clearly indicates a remarkable success of the training programme. It also shows how the adoption of new technologies by these farm women has created an outstanding impact on their livelihood and improved their economic conditions. The training imparted to these rural farm women has not only increased their knowledge but also exposure to modern technologies for small ruminant rearing.

IMPACT OF FARMERS' TRAINING



	Low level of knowledge (1-10)	Medium level of knowledge (11-20)	High level of knowledge (21-30)
Pre-training (%)	88.03	10.55	1.42
Post-training (%)	0.64	10.94	88.42



Hands on Training



Formal Class Room Training

5 | Input Supports provided to the Women Farmers

Eight hundred fifty good quality Garole sheep and Black Bengal goats from Germplasm centre were distributed among 425 selected and trained beneficiaries. Other inputs like vaccines, health care, animal feed and mineral supplements were also provided to these women farmers of Sundarban. Out of the 850 animals distributed, a total of 100 quality bucks and 50 quality rams have been distributed among these beneficiaries who helped in the improvement of the total sheep and goat population of these selected areas. The increase in terms of flock strength and growth was recorded.

Inputs like vaccine, health care, region-specific mineral supplements were provided to all the women farmers apart from these beneficiaries of Sundarbans. Quality sheep and goat feed (energy and protein-rich) have also been distributed.



Animal Distribution among the Rural Farm Women of Sundarbans.

6 | Performances in Farmers' Field and Economic Benefits accrued

Having distributed 850 quality Garole sheep and Black Bengal goat kid (out of which 150 male which helped in the enhancement of population growth) of the age of 8-10 months among the 425 trained farm women of Sundarban, efforts were made to distribute quality feed, mineral mixture supplementation and complete health care practice among the farmers. An average economic gain towards annual family income of 48% annually Rs 32,000/- (Table 7) has been observed among these farm women after implementation of the project. An enhancement of population strength of 141.57% (Table 6) among the selected beneficiaries has been recorded while overall enhancement of population strength of small ruminants was 36.36% in the entire project area. Such enhancement in income has also been observed through the sale of sheep and goats which is the positive impact of project activities.

Table 6: Performance of Flock Strength of Small Ruminant at Field level

Farmers Group	Small Ruminant	Before Initiation Of Project		2.5 Years After Implementation Of Project Work		Annual Enhancement	
		Total Flock Strength	Annual total sellable flock strength	Total Flock Strength	Annual total sellable flock strength	Total Flock Strength (%)	Annual total sellable flock strength (%)
Livestock farmers of the project area (excluding trained and beneficiaries of Biotech KISAN hub (N= 3372))	Black Bengal Goat	6,854	1,420	8,322	1,750	21.42	23.24
	Garole Sheep	920	240	1120	308	21.74	28.33
	Total	7,774	1,660	9,442	2,058	21.46	23.98
Trained Livestock farmers of the project area (excluding beneficiaries of Biotech KISAN hub (N= 427))	Black Bengal Goat	854	210	1120	284	31.15	35.24
	Garole Sheep	140	40	184	52	31.43	30.00
	Total	994	250	1304	336	31.19	34.40
Beneficiaries of Biotech KISAN hub (N= 425)	Black Bengal Goat	1,020	200	2,420	552	137.25	176.00
	Garole Sheep	130	42	358	90	175.38	114.29
	Total	1,150	242	2,778	642	141.57	165.29

Table 7: Economic gain in terms of Annual family income of the Farmers through Small Ruminant Practices

Farmers group	Small ruminant	Before initiation of project		Facilitates provided through Biotech KISAN hub	2.5 years after implementation of project work		Annual enhancement	
		Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)		Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (%)	Annual income per family (%)
Livestock farmers of the project area (excluding trained and beneficiaries of Biotech KISAN hub (N= 3372))	Black Bengal Goat	1895.00	64500.00	1. Animal Health care, 2. Awareness 3. Quality buck/ram for servicing	2270.00	72400.00	19.79	12.25
	Garole Sheep	290.00			356.00	22.76		
	Total	2185.00			2626.00	20.18		
Trained Livestock farmers of the project area (excluding beneficiaries of Biotech KISAN hub (N= 427))	Black Bengal Goat	1967.00	68400.00	1. Animal Health care 2. Awareness 3. Quality buck/ram for servicing, 4. Capacity building with Scientific sheep and goat rearing practices	2610.00	88900.00	32.69	29.97
	Garole Sheep	374.00			480.00	28.34		
	Total	2341			3090.00	31.99		
Beneficiaries of Biotech KISAN hub (N= 425)	Black Bengal Goat	1905.00	66250.00	1. Animal Health care, 2. Awareness 3. Quality buck/ram for servicing 4. Capacity building with Scientific sheep and goat rearing practices 5. Inputs like quality goat and sheep balanced animal feed and Mineral mixture	4208.00	98050.00	120.89	48.00
	Garole Sheep	380.00			890.00	134.21		
	Total	2285.00			5098.00	123.11		

7 | Entrepreneurship Development

Rearing of sheep and goats is a profitable business and has good economic prospects. In view of the successful implementation of the Biotech KISAN Hub in the Sundarbans area, such profitable business is gaining greater momentum in the area. Thus, **Entrepreneurship** development under the project creating opportunity for better livelihoods has been an encouraging output from the project. The primary objective of mobilizing these farm women into member-owned producer organizations or Farmers' Producer Organization (FPOs), is to enhance the production, productivity and profitability of the small and marginal farmers of the islands. The participant farmers were provided with the necessary support to identify appropriate crops relevant to their context particularly sheep and goat, providing access to modern technology through community-based processes including Farmers' Field Schools; their capacities will be strengthened and they will be facilitated to access forward linkages with regard to technology for enhanced productivity. Out of the eight proposed FPOs, four have already been formed (Table 8) while the formation of the other four are pending owing to lockdown caused by COVID 19 Pandemic. Till date, 22 number of Farmers' Interest Group (FIG) have been formed before the formation of these FPO which are fully functioning.

Table 8: List of Farmers' Producer Organization Under Formation

Sl no	District	Block	GP	Number of Farmers	Crops Name for FPC	Additional Crops	Name of Villages
1.	North 24 Pgs	Hingalganj	Sahebkhali	450	Sheep and Goat	Fish	4No.sahebkhali, Deuli & Ramapur
2.	South 24 Pgs	Gosaba	Amtali	350	Sheep and Goat	Chicken & Duck	Amtali
3.	South 24 Pgs	Gosaba	Chhotomollakhali	350	Sheep and Goat	Fish	Kalidaspur-8,9,6
4.	South 24 Pgs	Gosaba	Radhanagar-Taranagar	350	Sheep and Goat	Chicken & Duck	Taranagar, Baromollakhali


8 | Success Stories of Women Farmers

Empowering and investing in rural women is also pre-requisite to fulfilling the vision of the Sustainable Development Goals that aims to end poverty and hunger, protect the environment, improve health parameters and empower all women. This fact is reflected in the inspiring stories of women across the island of Sundarbans who has fought legal, social and cultural obstacles to bring about significant social and economic reforms in their family. The inspirational success stories of some of the women farmers through small ruminant farming are collated below:

8.1. Smt. Bandhabi Mondal

INTRODUCTION:

Sahebkhali village, a remote part of Hingalganj Block, located at Sundarbans, West Bengal has witnessed a success story of a backward female farmer with her small ruminant particularly Black Bengal goat rearing which has created a milestone and will definitely prove helpful in inspiring and ensuring participation of other farmers (men/women) for their social and economic upliftment. Smt. Mondal told that “I am doing goat farming as a source of income, but non availability of quality goats, the high cost of inputs and associated health hazards have always been a worry, but after the activities of Biotech KISAN hub started, all the problems have been resolved.”

Name of Farmer	Smt. Bandhabi Mondal	
Address	Village- Sahebkhali, Hingalganj Block, North 24 Pargans (Sundarban)	
Gender	Female	
Age	47 yrs	
Caste	SC	
Education	Class VIII	
Landholding	Agricultural land 1.5 Bigha,(93.84 Decimal) Non-Agricultural land 10 katthas(31.28 Decimal)	
Marital status	Married	
Occupation	Housewife	
No of Family member	6	

INTERVENTION OF BIOTECH KISAN:

As per mandate of the project, she was successfully trained in scientific goat rearing including first aid treatment, housing and overall management, feeding, common diseases of goats and their treatment, deworming and vaccination. Inputs like vaccine, health care, animal feed and mineral supplements have also been provided to her by Biotech KISAN Hub. She has also been provided

with superior quality 3 Black Bengal does and one buck obtained from the Germplasm centre of the project. Further, she has purchased 4 does from the local market.

ACHIEVEMENTS:

At present she has 16 Black Bengal does and one buck. She has opened her own bank account in local branch of cooperative bank. Being a member of a FPO, she has used to sell her farm products and invest her earnings in her bank account. Through sale of black Bengal goats, she has constructed a goat house made of concrete worth Rs 20,000/- approximately. In addition, Smt. Mondal also purchased 10 katthas (31.28 **Decimal**) of agricultural land investing Rs 25,000/- through the sale of her goats. It has also been observed that her average annual family economic gain in terms of family income is 97.84%. Her achievement in such a short time sounds remarkable and serves as good example for those who want to be an entrepreneur of small ruminant.

Initial Flock Strength	Initial sellable flock (Annual)	Animal provided by Biotech KISAN hub	Animal purchased	Total animal	Total Flock Strength	Annual total sellable flock strength	Total Flock Strength (%)	Annual total sellable flock strength (%)
3	4	4	4	11	17	24	127.27	500.00
Before initiation of project			2.5 years after implementation of project work			Annual enhancement		
Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (%)	Total Annual income per family (%)	
2,200.00	55,600.00	34,000.00	110,000.00	1445.45	97.84			

IMPACT ON OTHER FARMERS:

She is recognized as a progressive farm woman & Master Trainer among others farm women in the district. Being a master trainer she has been regularly providing training to the fellow farmers of her locality about scientific goat husbandry. She also provides her quality buck for mating does of other goat owners with nominal charges which reduced the possibility of inbreeding. She is now a source of inspiration for all the women and other farmers of the locality who are learning scientific goat husbandry practices for improving their livelihood. More than 100 neighboring women farmers have adopted quality goat rearing due to Smt. Bandhabi Mondal's success. Her experience has changed local perceptions about Black Bengal goat in the remote area of Sundarbans,.

8.2. Smt Dipali Biswas

INTRODUCTION:

Smt. Dipali Biswas is another good example of scientific Black Bengal Goat rearing success story as a result of Biotech-Kishan intervention. She is a farmer of a remote Sandelerbil village in Hingalganj

Block of Sundarbans. . In her household, she is responsible for postharvest operations (drying, winnowing, selecting and storing seeds), goat- and poultry-rearing, daily household chores such as cooking and collecting water, and child care. Farmers of sandelerbil are among the poorest in the district, and they are becoming poorer due to increasing salinity of the soil and farmers cannot grow any crops on their land and remain fallow during the Rabi season. Therefore, livestock rearing appeared an attractive alternative for livelihood security. In this perspective, the story of Smt. Dipali Biswas's successful Black Bengal goat to augment income becomes motivational among the farmers of the area.. She said that “she never thought that goat farming was possible in that area but Biotech KISAN Hub technological intervention made it possible”.

Name of Farmer	Smt Dipali Biswas
Address	Village Sandelerbil, Hingalganj Block, North 24 Pargans (Sundarban)
Gender	Female
Age	35 yrs
Caste	SC
Education	Class X (Madhyamik)
Landholding	Agricultural land 2.5 Bighas (156.4 Decimal), Non-Agricultural land 10 katthas (31.28 Decimal)
Marital status	Married
Occupation	Housewife
No of Family member	7



INTERVENTION OF BIOTECH KISAN:

Motivated by the scientific team of Biotech KISAN Hub, WBUAFS, Mrs. Biswas attended a training programme scientific rearing of small ruminants. . Through such capacity building training programme, she acquired skills and practical knowledge of scientific goat rearing including their behavior, management, feeding practices, common diseases and their preventive and curative measures. Enthused by her success in goat rearing, he has constituted a common interest group to select entrepreneurs interested in taking up goat rearing in her village. Subsequently, she was provided with best quality 3 Black Bengal does and one buck produced in the Germplasm centre of the project. In addition, she has purchased 4 does from the local market. Biotech KISAN Hub team provided critical inputs such as vaccines, animal feed and mineral supplements to her in scheduled time along with routine technical guidance and monitoring of the progress.

ACHIEVEMENTS:

The overall financial condition of Smt Dipali Biswas has improved remarkably after successful implementation of activities of Biotech KISAN hub on goat farming. She initiated goat farming with 3 does and one buck and at present she has 14 Black Bengal does and one buck as parent stock. Due to her profits from goat farming, she has been able to deposit Rs. 50000 in bank and also spent Rs. 20,000/- for her family health care purposes. The additional earnings from goat farming also enabled her to get two room brick house constructed.. As such, her average annual family economic gain is 79.15% which is very impressive one.

Initial Flock Strength	Annual Initial sellable flock strength	Animal provided by Biotech KISAN hub	Animal purchased	Total animal	Total Flock Strength	Annual total sellable flock strength	Total Flock Strength (%)	Annual total sellable flock strength (%)
4	6	4	4	12	15	22	91.67	266.67
Before initiation of project			2.5 years after implementation of project work			Annual enhancement		
Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (%)	Total Annual income per family (%)			
3,700.00	61,400.00	39,200.00	110,000.00	959.46	79.15			

IMPACT ON OTHER FARMERS:

Smt. Dipali Biswas is now an established profit-making goat farmer due to scientific intervention of Biotech KISAN and serves as trainer to the others farm women in her district. The profitability of goat farming demonstrated by her, inspired other farmers to follow to adopt goat farming. .

8.3. Smt. Tanima Sarkar Mondal**INTRODUCTION:**

Smt. Tanima Sarkar Mondal is a resident of Kachukhali village under Gosaba Block of Sundarban. Her goats were showing poor growth rate and poor returns mainly due to poor feeding management and insufficient health services in her village. WBUAFS through Biotech KISAN hub provided her scientific knowledge and training to address the problem of feed and health management. After her training and inputs from Biotech KISAN Hub, growth rate and returns from the goat rearing improved dramatically. Smt. Tanima Sarkar Mondal is now offering help and advice to other farmers for scientific goat rearing in Gosaba block.

2	4	4	4	10	12	25	100.00	525.00
Before initiation of project			2.5 years after implementation of project work			Annual enhancement		
Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (%)	Total Annual income per family (%)			
2,600.00	51,400.00	38,000.00	92,000.00	1361.54	78.99			


IMPACT ON OTHER FARMERS:

The story of Smt Tanima Sarkar Mondal is motivating to other women goat farmers to become entrepreneurs. Since the goat meat is in great demand for the preparation of favorite local cuisines, her success has motivated her fellow villagers especially the womenfolk to rear Black Bengal goats as a means of nutritional and livelihood security and generation of additional income.. A large numbers of farmers from adjoining areas have visited her goat farm and have been inspired to follow the scientific goat rearing practices. . .

8.4. Smt. Gitarani Mondal

INTRODUCTION:

Small ruminants particularly rearing of Garole Sheep is an example of profitable enterprise for alternative livelihood. Smt. Gita Rani Mondal is a woman farmer from Sandelerbil village in Hingalganj Block of Sundarban. She was a house wife but now she is a successful entrepreneur in her locality which is the poorest part in the district. Her story creates a motivational opportunity among the farmers of the entire area. surrounded by river and forest has witnessed another success story in small ruminant particularly Black Bengal Goat and Garole sheep rearing as their livelihood.

Name of Farmer	Smt. Gitarani Mondal	
Address	Village Sandelerbil, Hingalganj Block, North 24 Pargans (Sundarban)	
Gender	Female	
Age	55 yrs	
Caste	SC	
Education	Class IV	
Landholding	Agricultural land 2 Bigha (125.12 Decimal), Non-Agricultural land 10 katthas (31.28 Decimal)	
Marital status	Married	
Occupation	Housewife	
No of Family member	11	

INTERVENTION OF BIOTECH KISAN:

Following the mandate of the project, she has been successfully trained in scientific Garole sheep rearing including first aid treatment, housing and overall management, feeding, common diseases of sheep and their treatment, deworming and vaccination. Inputs like vaccine, health care, animal feed and mineral supplements have also been provided to her by Biotech KISAN Hub. She has also been provided with best quality 3 Garole ewes and one ram obtained from the Germplasm centre of the project. In addition, she has also purchased 4 ewes from the local market. Interventions that involve the genetic improvement of animals that is passed on from one generation to another generation are more likely to sustain beyond the life of the intervention. Interventions such as enhancing awareness, establishing and strengthening community organizations, and linking them with existing structures such as SHGs are also likely, with some monitoring, to sustain themselves after the project is over.

ACHIEVEMENTS:

Now Smt. Gitarani Mondal is now an established progressive small ruminant farmer of Sundarbans and owner of around 12 Black Bengal does, 17 Garole ewes and one ram. She is now a successful entrepreneur. Due to success in livestock rearing now she has gained considerable importance in family as well as society. The profitable returns from sale of livestock and livestock products have enabled her to purchase 2 bigha (125.12 Decimal) agricultural land, worth Rs 1,00,000/- approximately, in her village. In addition, She has also constructed two-room brick house worth Rs, 40, 000/-. Her average annual family economic gain is 93.37%.

Animal	Initial Strength	Annual total sellable flock strength	Animal provided by Biotech KISAN hub	Animal purchased	Total animal	Total Flock Strength	Annual total sellable flock strength	Total Flock Strength (%)	Annual total sellable flock strength (%)
Goat	2	4		4	6	12	12	100.00	200.00
Sheep	4	4	4	4	12	18	18	66.67	350.00

Animal	Before initiation of project		2.5 years after implementation of project work		Annual enhancement	
	Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (%)	Total Annual income per family (%)
Goat	2600.00	72,400.00	22,000.00	140,000.00	746.15	93.37
Sheep	3,600.00		26,000.00			

IMPACT ON OTHER FARMERS:

Joint family of eleven members is fully contributing to small ruminant farming thus saving cost on labour. Without depending on the middlemen, direct marketing of livestock produce in the nearby markets has given them better price as she has become a member of FPO. She is now a successful woman farmer and serves as a Master Trainer for the other farmers in that area.

Due to more profitability of sheep and goat farming demonstrated by the intervention of Biotech KISAN, several other farmers in the area have shown interest and she has provided them quality animals. . Hundreds of farmers from adjoining areas have visited her farm and have been inspired to follow the practice. .

8.5. Smt. Arati Mandi Hembram**INTRODUCTION:**

Smt. Arati Mandi Hembram is another successful Garole sheep farmer through the intervention of Biotech KISAN. This tribal farm woman belongs to Nafarganj under Gosaba Block of Sundarbans surrounded by river and forest. She has participated in various trainings conducted by Biotech KISAN hub, WBUAFS, to update her knowledge on the modern husbandry practices. In these flood and cyclone prone areas, the sheep farming is closely interwoven with tribal culture and is vital in ensuring food and livelihood security among poor household. A tribal woman has braved to make a fortune in such situation through adoption of scientific methods of sheep and goat farming. She has told that “Biotech KISAN Hub intervention was a game changer in her livelihood security and income generation”.

Name of Farmer	Smt. Arati Mandi Hembram	
Address	Vill-Nafarganj, Block-Gosaba, District- South 24 Pgs. (Sundarban)	
Gender	Female	
Age	39 yrs	
Caste	ST	
Education	Class VII	
Landholding	Agricultural land 2 bigha (125.12 Decimal)	
Marital status	Married	
Occupation	Housewife	
No of Family member	6	

INTERVENTION OF BIOTECH KISAN Programme:

Smt Hembram was successfully trained in both theoretical and practical lessons on Garole Sheep rearing including first aid treatment, housing, overall management, feeding, common diseases of sheep and their treatment, deworming and vaccination. She has also been provided with best quality 3 Garole ewes and one ram obtained from the Germplasm centre of the project. In addition, she has also purchased 4 ewes from the local Market. Inputs like vaccine, health care, animal feed and mineral

Empowerment of Women Farmers in Sundarban

supplements have also been supplied to her by Biotech KISAN Hub. In order to bridge the technological gap between the research farm and the farmers of the remote Sundarban area; distribution of quality animal and regular supervision was done by Biotech KISAN hub, WBUAFS since 2017-18.

ACHIEVEMENTS:

Presently, Smt. Arati Mandi Hembram is a well-known progressive farmer of Sundarban having farm strength of 16 Garole ewes and one ram. Apart from being a successful entrepreneur, she has earned a lot of respect in family as well as in the society. She has purchased 1 bigha (62.56 Decimal) agricultural land, worth Rs 50,000/- approximately, in her village by selling her Garole Sheep. She is now a member of a Farmers' Producer Organization and her problem of marketing of sheep has been sorted out and she can now save her profit in her own bank account for utilization during the need. She has engaged her husband in a tea stall in local market for which an amount of Rs 30,000/- approximately has been invested by selling Garole Sheep. Though she started her farming practice late, her average annual family economic gain is 89.78% which is remarkable in present context.

Initial Flock Strength	Annual total sellable flock strength	Animal provided by Biotech KISAN hub	Animal purchased	Total animal	Total Flock Strength	Annual total sellable flock strength	Total Flock Strength (%)	Annual total sellable flock strength (%)
6	4	4	4	14	22	21	57.14	425.00
Before initiation of project			2.5 years after implementation of project work			Annual enhancement		
Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (Rs)	Total Annual income per family (Rs)	Per family Annual return from Goat/Sheep (%)	Total Annual income per family (%)			
4,100.00	68,500.00	38,000.00	130,000.00	826.83	89.78			

IMPACT ON OTHER FARMERS:

Smt Hembram has taken numerous trainings and has utilized other facilities from the project and thus has attained a distinctive identity as a sheep farmer in her area within a short period of time. Students and farmer groups from the different part of district visit her livestock farm. This encourages her to involve more in this farming operation also getting wider publicity. The social acceptance and recognition she and her family receive give them more satisfaction and joy in addition to the economic gains and higher living standards achieved. Due to higher profitability of the sheep farming on the Island, many farmers in the area have shown interest and she has provided quality animals to them. The additional income from the sheep rearing particularly, during the lockdown period due to the outbreak of COVID-19 has been a boon for the farmers. Further, the profit earned by the Garole sheep in the island under the programme has acted as eye opener for the other tribal farmers of the area as well.

9 | Way Forward

The program, undertaken by the Biotech KISAN Hub for women empowerment through creation of small scale enterprise of small ruminants in Sundarban, has demonstrated to be a potentially successful model for economic gain in terms of enhancing an average annual income of Rs. 32,000/ per annum which turns out to be around 48% increase annually. Further, such enterprises can easily be executed by the women, this can become an additional source of income to the farmers especially small and marginal farmers of the island. Creation of Farmers' Producer Organization (FPO) helped further in procuring inputs and selling the produce at right price. The success of the program has helped the women farmers in creating movable as well as small immovable assets like jewelry and houses etc. Education of the farmers in ploughing back part of the profit in expanding their enterprise will result in higher income and, in turn, bigger impact.

Since most of the areas of Sundarban are prone to natural calamities like cyclone, sea water logging and flood; special emphasis may be given to ensure the livelihood security of the small and marginal farmers especially women farmers by promoting small ruminant farming as the crop husbandry is comparatively more susceptible to be adversely affected by the natural calamities.

Thus, such programmes should now be promoted by the state department of Animal Resource Development to cover a large number of farmers in other remote areas of the island to improve socio- economic conditions of the resource-poor Islanders of Sundarban. Apart from this, special attention may also be given for conservation of valuable genetic resource of indigenous small ruminant present in Sundarban Island.



Bio-Tech KISAN Hub
Directorate of Research, Extension and Farms
West Bengal University of Animal and Fishery Sciences