



GOYA: An improved crossbred pig variety of Goa



भाकृअनुप - केन्द्रीय तटीय कृषि अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद)

ओल्ड गोवा - ४०३ ४०२, गोवा, भारत

ICAR-CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE
(Indian Council of Agricultural Research)

Old Goa - 403 402, Goa, India

Monograph No. 01/2024.

GOYA: An improved crossbred pig variety of Goa

Amiya Ranjan Sahu

E.B. Chakurkar

Gokuldas P.P

Chethan Kumar H.B

N.H. Mohan

V.K. Gupta

Parveen Kumar



भाकृअनुप - केन्द्रीय तटीय कृषि अनुसंधान संस्थान

(भारतीय कृषि अनुसंधान परिषद)
ओल्ड गोवा - ४०३ ४०२, गोवा, भारत

ICAR-CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE

(Indian Council of Agricultural Research)

Old Goa - 403 402, Goa, India

Compiled and Edited:

Amiya Ranjan Sahu, E. B. Chakurkar, Gokuldas P.P, Chethan Kumar H.B, N. H. Mohan, V. K. Gupta and Parveen Kumar

Published by:

Dr. Parveen Kumar

Director

ICAR - Central Coastal Agricultural Research Institute

Ela, Old Goa – 403 402

Fax: 0832-2285649

Phone: 0832-2284678, 2284679

E-mail: director.ccari@icar.gov.in

Website: www.ccari.icar.gov.in

Secretarial Assistance:

Shri Sidharth Marathe

Assistant Chief Technical Officer

PME Cell

Correct citation:

Sahu A. R., Chakurkar E. B., Gokuldas P.P, Chethan Kumar H.B, Mohan N. H., Gupta V. K. and Parveen Kumar (2024). Goya: An improved crossbred pig variety of Goa. Monograph No:01/2024, ICAR-Central Coastal Agricultural Research Institute, Ela, Old Goa-403 402, Goa, India. Pp. 32.

Copyright @ 2024, ICAR-Central Coastal Agricultural Research Institute

All Rights Reserved for reproduction of this document or any part thereof, Permission of ICAR-Central Coastal Agricultural Research Institute, Old Goa must be obtained.

Contents

Sl. No.	Title	Page No.
Chapter 1	Introduction	5 - 6
Chapter 2	Climate and Geographical Distribution	7 - 9
Chapter 3	Morphometric characteristics of Goya pig	10 - 11
Chapter 4	Performance Traits of Goya Pig	12 - 14
Chapter 5	Managemental Practices	15 - 26
Chapter 6	Artificial Insemination in Goya pigs	27 - 31
	References	32

ACKNOWLEDGEMENTS

Authors are thankful to the Director, ICAR-National Research Centre on Pig, Guwahati for valuable guidance and providing funding support through All India Coordinated Project on Pig. Our sincere thanks to Dr. N.H. Mohan, Principal Scientist, ICAR-NRC on Pig for his generous support and coordination with the project team for implementation of the project at ICAR-CCARI, Goa. The tremendous efforts and hard work of farmers maintaining breedable population of Goya pig variety are also highly acknowledged. We also thank the project and contractual staff of the institute pig unit for their continuous engagement in maintain the farm animals, recording performance of pigs, collection of breeding data and helping in the field level studies of this variety. At last, we would like to express our deepest sense of gratitude to the PME cell, scientific, administrative, technical and supporting staff of ICAR-CCARI, Goa for their immense support and cooperation.

Amiya Ranjan Sahu
E.B. Chakurkar
Gokuldas P.P
Chethan Kumar H.B
N.H. Mohan
V.K. Gupta
Parveen Kumar



Introduction

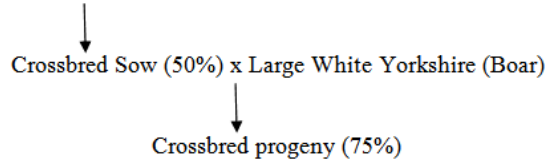
From being an imperative waste disposal system to being on our food tables, pigs have come a long way. Like any other livestock, pigs convert inedible feed, forages, certain grain by-products, and garbage into a valuable nutritious snack. Goa being a tourist destination has many hotels and hence, rearing of pigs, besides being a sustainable way of getting rid of hotel waste, is also a good earning option, especially for landless farmers who can adopt pig rearing to supplement their livelihood.

Large White Yorkshire (LWY) is an exotic breed of pig well known for its high body weights among farmers of coastal India. But the adaptability to the hot and humid climate is a major problem in rearing this pure breed. On the other hand, black coloured indigenous Agonda Goan pig is a small-sized animal preferred by the local population for its taste and lean quality meat. Keeping both the problems in view, efforts were made to cross exotic Large White Yorkshire boars with indigenous Agonda Goan sows in the All India Coordinated Research Project (AICRP) on Pig Centre, ICAR-Central Coastal Agricultural Research Institute, Goa. The AICRP project was funded by ICAR-National Research Centre on Pig, Guwahati, Assam. Research efforts were aimed at developing crossbred progenies. Selective *inter-se breeding* method was employed to achieve inheritance of 75% Large White Yorkshire and 25% Agonda Goan pigs. The resultant crossbred variety was named as Goya pig as it is the cross of Agonda Goan and Yorkshire, and Goa state is also spelled as Goya in local language Konkani.

This improved crossbred pig is characterised by large size, white colour with occasional black markings, good litter size and mothering ability and most adaptable to the hot and humid climate of Goa and adjoining coastal states attaining body weight of 90 kg at the age of 10 months. The detailed breeding plan for development of Goya pig variety is depicted below.

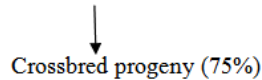
(A) Cross Breeding

Agonda Goan (Sow) x Large White Yorkshire (Boar)



(B) Selective Breeding in each generation

Crossbred Sow (75%) x Crossbred boar (75%)



Breeding plan for development of Goya pig

The Goya variety were fed with three types of concentrate feed i.e., starter, grower and finisher ration. Starter feed were given till the animals attained 15-20 kg body weight, followed by grower feed up to attainment of 50 kg body weight and then finisher feed till marketing at around 8 months of age. The pigs were routinely dewormed and vaccinated against Classical Swine Fever vaccine and Circovirus vaccine as preventive health measure. Artificial insemination was performed using chilled liquid semen to enable rapid genetic improvement in the herd and avoiding inbreeding. Sows were selected for breeding which belongs to high litter group and with more number of teats. Healthy boars having high birth as well as weaning weights, early maturity and optimal breeding soundness attributes were selected for breeding.

Mean litter size at birth is 10 with birth weight of 1.07 kg per piglet were recorded. An appreciable production performance was achieved with 8.25 kg weaning weight (40 days of age) and 75 kg weight at marketing (8 months of age). Better growth and reproductive potential, good meat quality, docile nature and strong maternal instincts are main features for which this variety is highly preferred in the farmers' field. There is a wider scope for augmenting pig production and this developed variety can thrive well in prevailing hot humid coastal climate. Developed variety is suitable for both in small and marginal farming as well as in commercial piggery enterprise with good potential for high economic return. Target areas include coastal districts of Goa, Maharashtra, Karnataka, and Kerala. Pig farmers, commercial pig production enterprises, agri-entrepreneurs and state animal husbandry departments are the potential target groups.



Climate and Geographical Distribution

Goya is a climate resilient crossbred pig variety suitable for pork production with better productive performance and adaptability to hot and humid coastal climate. The environment of the distribution tract is characterized as coastal and tropical climate, largely influenced by its proximity to the Arabian Sea. These areas experience warm and humid conditions throughout the year. The peak temperatures are observed in the month of May, with daytime highs reaching approximately 35°C, accompanied by high humidity levels (80-90%). The onset of the monsoon season typically occurs in early June, bringing substantial rainfall and relief from the heat. The monsoon period, which extends until late September, is responsible for the majority of the annual precipitation, averaging around 350 cm. Rainfall during the monsoon can range from 250 cm to 300 cm. A brief cool season occurs between mid-December and February, characterized by cooler nights with temperatures around 20°C and warm days reaching about 29°C. During this time, humidity levels are moderate, and there is a marginal decrease in night time temperatures. The climate does not exhibit extreme temperatures or distinct seasonal changes, except for the monsoon period. Throughout the year, the average daily sunshine duration is nine to ten hours during the summer and reduces to three to five hours during the monsoon. As the monsoon season approaches in the two months prior, humidity levels rise significantly, and the skies transition from clear to hazy and then cloudy. From October to February, the weather is generally stable, featuring clear skies, warm but not excessively hot days, and calm sea level. By mid-March, increasing humidity signals the impending arrival of the monsoon season.

Pork is a widely consumed meat in this region, particularly among Portuguese Christians and other communities in Goa. Meat consumption and demand are also high due to high tourist footfall in the region. Pork is a significant source of animal

protein for the local population. The Goya pig is crucial to the economic success of pig farmers in this area. Pigs are commonly raised as a backyard enterprise, largely supported by the abundant availability of hotel waste generated by the tourism industry. This variety is known for its adaptability and its ability to efficiently utilize locally available feed resources.

The technology developed by ICAR-CCARI, Goa (under the project entitled “All India Coordinated Research Project on Pig” of ICAR-NRC on Pig, Guwahati) has been disseminated across various regions of Goa, Maharashtra, and Karnataka through training, demonstration and distribution programs. The geographical distribution of the variety is depicted below.

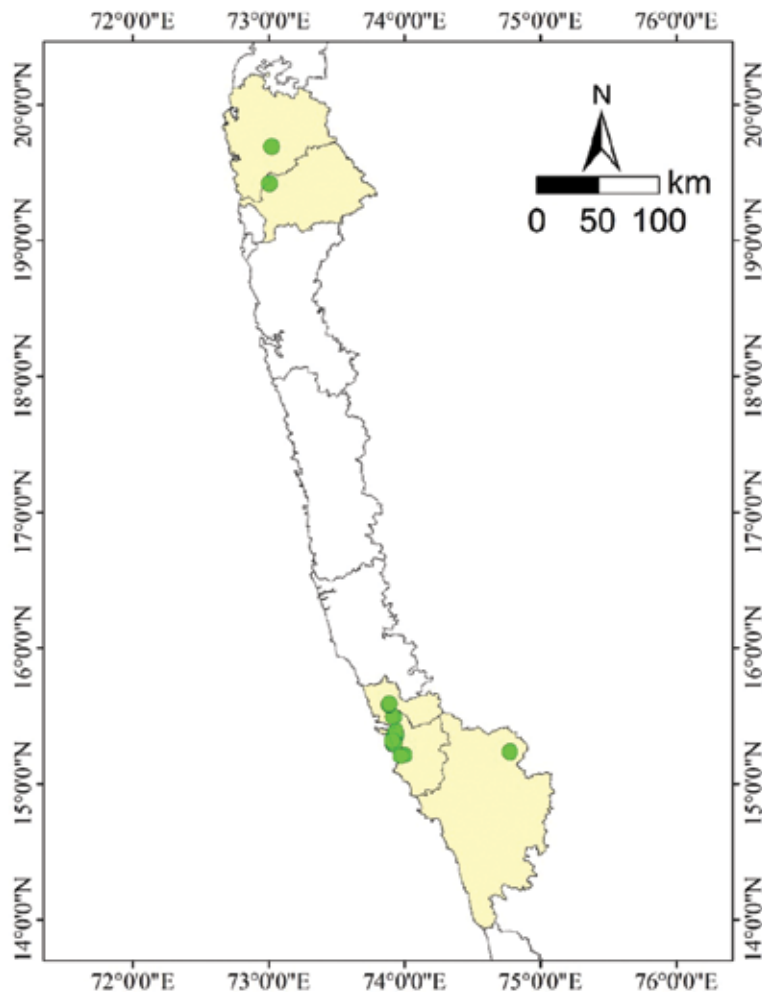


Fig. Map showing distribution of Goya pig

Some of the images of rearing of the Goya pig in the institute pig unit and farmers' field is given below.



An adult female Goya pig



An adult male Goya pig



A female Goya pig nursing the piglets



A group of adult Goya pigs in the in the institute farm



Morphometric characteristics of Goya pig

Scientific study on colour, appearance, skin, body size and conformation, hairs and bristle, ear, eye backline and other breed characteristics were undertaken to derive the phenotypic characteristics of the crossbred variety. Other morphometric characters including body length, chest girth, height at wither, neck girth were also recorded. The data were collected from the distributed areas of the farmers' field and piggery unit of the ICAR-CCARI, Goa.

Physical characteristics

Goya is a large sized crossbred pig variety of Goa. The overall colour is largely white with occasional faint patches of black hairs, with fine and short bristles and well-placed teats on both sides of the ventral line. The snout is straight and small in size that helps those animals in the scavenging system of rearing for searching feed.

Morphometric characteristics

Body colour: These pigs are mostly white coloured with occasional faint patches of black hair

Appearance: These pigs are active but docile in nature with better alertness

Coat: The coat of Goya pig is characterised by fine and short bristles

Body size: The animals of this breed are generally large in size

Face: Face is generally white but with occasional black markings

Snout: The snout of Goya pig is small and straight

Legs: Legs are generally white in colour

Hoof: Generally, hoof is well place and full

Ears: These pigs have erect ears

Top-line: The top-line is straight

Belly: The animals have horizontal belly

Bristle: It has fine and short bristles

Teats: Average number of teats in Goya pig is 14. Teats are well placed teats with strong maternal instinct and docile in nature.

Tail: Tail is medium-sized and straight in most cases

Temperament: These pigs are quite easy to handle compared to the indigenous pigs because of their docile nature.

Climatic adaptation: Goya pig variety is well-suited to the coastal climatic conditions and thus can be recommended for the coastal states with hot and humid tropical climate. The pigs have better disease resistance and adaptability to stress compared to exotic breeds.

The measurements of different body parts of Goya pigs are given in the table below:

Table: Body measurements of Goya pig

Parameters	Mean	Performance	
		Range	
Chest girth (cm)	Male	107	93-123
	Female	103	89-117
Body length (cm)	Male	106	98-119
	Female	102	91-114
Height at withers (cm)	Male	68	62-78
	Female	66	59-74
Neck girth (cm)	Male	83	68-106
	Female	78	66-101



Performance Traits of Goya Pig

Pigs are primarily raised for pork production, with the economic viability of rearing largely dependent on key performance traits such as growth rate, feed efficiency, litter characteristics and carcass quality. Consequently, pig breeding programs are mostly aimed to enhance these traits genetically.

Growth performance:

Growth performance is directly linked to efficiency of pork production which in turn affects the profitability of pig farming. The average body weight of Goya pig at birth, weaning and marketing are 1 kg, 8 kg and 75 kg, respectively. The body weights of Goya pig at different stages of life are given in the below table.

Table: Growth performance of Goya pig

Age	Male (kg)	Female (kg)	Average (kg)
At birth	1.08 ± 0.04 (78)	1.06 ± 0.03 (76)	1.07 ± 0.03 (154)
Weaning (40 days)	8.25 ± 0.35 (76)	8.13 ± 0.47 (66)	8.19 ± 0.41 (142)
2 month	13.14 ± 0.32 (70)	11.20 ± 0.96 (71)	12.17 ± 1.37 (141)
3 month	24.12 ± 1.70 (31)	19.98 ± 1.60(36)	22.05 ± 2.93 (67)
4 month	29.90 ± 2.50 (19)	28.34 ± 2.08 (27)	29.12 ± 1.10 (46)
5 month	40.20 ± 2.86 (15)	36.19 ± 2.10 (27)	38.20 ± 2.84 (42)
6 month	52.42 ± 2.31 (15)	50.40 ± 3.33 (26)	51.41 ± 1.43 (41)
7 month	62.64 ± 3.10 (15)	60.72 ± 3.32 (26)	61.68 ± 1.36 (41)
8 month	78.91 ± 3.28 (12)	71.57 ± 2.48 (24)	75.24 ± 5.19 (36)
9 month	88.41 ± 1.32 (11)	79.65 ± 2.90 (21)	84.03 ± 6.19 (32)
10 month	108.46 ± 4.31 (11)	96.04 ± 3.99 (21)	102.25 ± 8.78 (32)

(Figures in the parentheses indicate the number of observations)

Average daily gain:

The pre-weaning (up to 40 days) and post weaning (41-240 days) growth rates of Goya pig are 200 gm/day and 340 gm/day, respectively. The growth curve of Goya pig is given below.

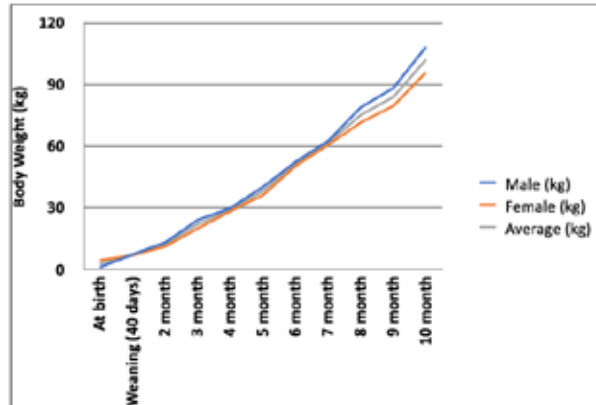


Fig. Growth curve of Goya Pig

Reproductive Performance:

The profitability of pig farming is influenced by both growth rate of the animals and their reproductive performance. Optimal reproductive efficiency in breeding boars and sows leads to increased profitability. Key reproductive traits impacting economic outcomes include litter size, litter weight, age at first farrowing, gestation length, generation intervals etc. The age of male Goya pig at first mating is 210 days while that of the female is 175 days. The range of litter size at farrowing is 5 to 14. The overall reproductive performance of Goya pig is summarised in the table below.

Table: Production and Reproduction performance of Goya pigs

Trait	Mean \pm SE	Range
Litter size at birth (nos.)	9.58 \pm 0.45	5 - 14
Litter size at weaning (nos.)	8.38 \pm 0.41	4 - 13
Individual weight at birth (g)	1070 \pm 0.04	400 - 1700
Individual weight at weaning (kg)	8.25 \pm 0.34	4.6 - 14.9
Age at first farrowing (days)	284	222 - 420
No. of farrowing in life	7	4 - 10
Oestrous cycle duration (days)	21	18 - 23
Age at first oestrous (days)	153	98 - 185
Oestrous duration (hours)	30	20 - 36
Farrowing interval (days)	193	157 - 235

Carcass Characteristics

Goya pig is a climate-resilient crossbred pig variety suitable for pork production with better production performance and adaptability to hot and humid tropical coastal climate. Pork is commonly available in Goa and consumed largely by the Catholic community, which accounts for 26% of the state's population, as well a small chunk of the majority Hindus, but the meat is regular fare in the state's coastal tourism-oriented belt, which annually attracts over half a million foreign and three million domestic tourists. In this context, Goya pig has greater potential as it has high dressing percentage ranging from 68 to 80 %. The overall carcass traits of Goya pigs are depicted below.

Table: Carcass characteristics of Goya pig

Carcass weight (kg)	Hot	58.5	38.9 - 83
	Cold	54.3	35.3 - 79.8
Dressing percentage (%)		74.3	68 - 80
Carcass length (cm)		105	96 - 114
Loin eye area (inch ²)		4.8	3.9 - 6.3
Back fat thickness (cm)		2.4	1.6 - 3.4
Feed conversion efficiency (FEC) up to 8 months		3.95	3.3-5.4



Managerial Practices

System of rearing of Goya pig:

Pig farming represents a long-standing agricultural tradition among farmers in Goa, who have raised pigs in backyard settings across generations. Pigs are versatile omnivores, capable of consuming a diverse range of feedstuffs, including grains, restaurant by-products, vegetables, fruits, sugarcane residues, and bakery waste. In Goa, pigs are commonly integrated into the backyard environments of local residents. In more structured farming operations, pigs are managed under regulated feeding regimes and selective breeding practices. Due to their superior feed conversion efficiency, pigs exhibit rapid weight gain even under sub-optimal maintenance conditions, which is a key indicator of successful livestock management. These pigs are typically slaughtered during major cultural and religious events such as Christmas, New Year celebrations, and other festivities.

Housing system:

Pig houses should be built to ensure optimum comfort and shelter to the pigs, provide protection from inclement weather, snakes and other predators, as well as protection from major swine diseases. The sheds are constructed depending on the system of rearing in the locality as well as the financial status of the farmers. The sheds are designed based on intensive, semi-intensive, or extensive systems of rearing. The layout and style of pig houses vary according to the soil and climatic conditions. The location of the farm is very important. It should be in a place that easy to reach, good road connectivity, easy to transport animals and feed, and most importantly availability of clean and continuous water supply.

Housing provides shelter and protection. Pig shed should be constructed on dry and raised ground. Long axis of house should be 30-35 meter and in East to West

orientation for tropical regions. The height of the roof should be 8-10 ft. The sidewalls (up to 4 ft from ground) of the shed should be constructed with brick and cement plastered and polished. The remaining height (upper 4-6 ft.) can be made up of wire net/bamboo. The floor should be hard or pucca, non- slippery and sloppy. Feeding and water troughs should be constructed in the pen and the corners of the walls. Troughs and drain should be rounded for easy cleaning. Provision for creep box should be made in farrowing pen. Provision for adequate open space for exercise, sufficient water and facility for proper disposal of faeces should be created. Individual pens should be of uniform size (80-100 sq. ft). Different categories of pigs, such as breeding boar, farrowing sow, piglets, growers (3-6 months old), fatteners (above 6 months old) and gilts/dry sows can be accommodated in a pen of this size.

Adequate space should be provided to the animals. The housing space requirements for various categories/ age groups of pigs are given in the following table.

Type of animal	Floor space requirement (sq. m. per animal)		Maximum number of animals per pen
	Covered area	Open paddock	
Boar	6.0-7.0	8.8-12.0	Individual pens
Farrowing pen	7.0-9.0	8.8-12.0	Individual pens
Fattener (3-5 months old)	0.9-1.2	0.9-1.2	30
Fattener (above five months)	1.3-1.8	1.3-1.8	30
Dry sow/gilt	1.8-2.7	1.4-1.8	3-10



Housing in farmer's field

Houses for different categories of pig

Pigs are housed in Sties, which are separated into one or more pens, with each pen containing a single or group of animals based on age, sex, and purpose. The size of the pen is determined by the number of animals to be kept and the floor area provided per animal. Different sorts of Sties are available for different categories of pigs in big scale commercial piggeries for easier control.

Breeding boar pen

Protection of boars from temperature extremes is critical, since high temperatures can quickly lead to decreased sperm fertility and libido. Strongly built boar accommodation is needed, especially to prevent boars from escaping and fighting. Wire reinforcements can be utilised for walls, however door bolts and hinges must be of high quality. Each boar sty shall not contain more than one animal per pen. The floor area of a boar pen should be 7m², but if the pen is to be utilised for servicing, the minimum floor space need is 9m².

Breeding sow pen

There are usually 20-40 pens in each farrowing style, with each pen holding a female and her litter. The farrowing style should be built with enough space for the feeding female to sleep and the piglets to move around. Piglets should be provided with the compartment in the farrowing room which should be 2 meters high and should have an opening of about 10-12 inches in the front of the nursing female. Each compartment should have a water and feeding trough. Guard rail should be provided 25 cm above the floor level. Heating lamp can be provided.

Grower or Fattener pen

Piglets can be weaned/separated from mothers in 25-40 days. Each weaned piglet requires 0.3-0.5 square meters of space per piglet. 20-25 pigs can be kept in a room. Grower pig requires 0.5-1 sq. m area per pig. It can be grouped into numbers 8-12. Adequate feeding area with more than one watering nozzle should be available. Care should be taken that pigs of equal weight are kept together.

Feeding system of Goya pig:

Pig is the most efficient animal in converting feed to meat. The productivity of

pig farm depends on the quality as well as quantity of feed supplied to the pigs. The quality of the carcass produced for the market determines the profitability of the pig farm. In scientific rearing, a balanced ration contains carbohydrates, proteins, fat, minerals and vitamins with sufficient cleaned water. Maize, Wheat bran, Rice polish, broken rice, ground nut cake, fish meal, mineral mixture and salt are the common ingredients of feed. Feeding vegetable waste, kitchen waste available from the nearby hotels and locally available non-conventional feed resources like brewery and bakery waste etc. can also be used as feed as supplements to concentrate feed which in turn can minimize the cost of production.

Balanced high-quality ration must be provided to the pigs to achieve the better growth at marketing age. Three types of rations are fed to pigs i.e. starter, grower and finisher rations. The starter feed is fed up to 3 months of age (attains up to 15-20 kg body weight), followed by grower feed from 4-6 months of age (attains up to 50 kg body weight) and finisher feed till marketing age (70-90 kg body weight). However, most of the farmers feed their pigs with easily available feed resources like hotel waste, bakery products, kitchen waste, and vegetable waste from market as unconventional feedstuff.



Feeding in circular tray in farmer's field

Feeding of pregnant animals

Feeding extra allowance of grains by about 500 to 700 grams before breeding season is called flushing. This is done to increase energy level in diet for increasing ovulation rate in gilt and sows, so that they may gain body weight from 0.5-0.7 kg daily from 1-2 weeks before breeding season. Pregnant sows require ration that is

fairly high in minerals and vitamins in order to produce large litters of healthy pigs. Restricted feeding with approximately 15% protein content and 2-3% mineral mixture should be practiced to prevent excessive fat deposition during pregnancy. A daily gain of 250-300 g is satisfactory in pregnant sows during the entire gestation period. The ration should be made more laxative three or four days before farrowing. It is very important to meet the nutritional requirements during pregnancy as deficiency of nutrients like calcium, phosphorus and Vitamin A can have adverse effects on the growth of neonates.

Feeding of lactating sows

The requirement of lactating female is higher than during lactation period. Milk production by sows becomes important to piglet growth on around 8th day of lactation. Sow's milk contains about 81% water, 5-6% fat, 6-7% protein, 5-6% lactose and 1% ash. Therefore, the sow must receive feeds containing these nutrients in sufficient amounts to produce the milk required by the litter. Ration for sows during lactation will depend upon nutritional need of piglets, however 2.5-3.6 kg ration per day will be enough for 8-10 piglets. Gain in weight of suckling piglets is directly proportional to producing ability of the mother.

Feeding of boars

Breeding male pigs should be kept in thrifty condition. Protein in the ration of pig should be around 16 per cent. Pigs should not be too fat as it weakens the legs and fertility. The boars should be fed regularly with supplement of concentrate feed to maintain good health.

Feeding of piglets

The piglets need to consume 250-300 ml of colostrum (586-628 KJ/100 ml) to remain in energy balance. Piglets can sustain exclusively on sow's milk for 7-10 days only. They are helped to suckle about 8-10 times a day. Subsequently, at the age of 7-10 days, piglets should be supplemented with concentrate feed which is kept in creep or trough in a separate pen to prevent access of the sow. This feed is also called creep feed. The creep feed should be more palatable ration, higher in protein and supplemented with antibiotics and lower in fibre content. The piglets may also be provided with milk replacer in absence of mother. Lack of iron and copper salt in

milk of sow results in piglet anaemia. So mineral mixture and multi-vitamins should be supplemented with creep feed.

Care of pregnant sow

Balanced ration is given for nourishment of sow, development of foetus and better birth weight. Avoid unnecessary stress to sows and provide plenty of drinking water. Avoid overcrowding, mixing of new and old stocks and over exciting of pregnant pigs. Separate, clean and dry sty with non-slippery floor (before 10 days) with bedding of 8-10 cm of chopped straw under covered area (should be provided). Deworm the pigs 2 weeks before farrowing (Fenbendazole @ 5mg/kg bw). Treatment of sows against external parasites (Deltamethrin or cypermethrin @ 0.01-0.05%). Trim overgrowth toe, scrub with soap and warm water in sides, udder and interdigital spaces in pregnant sow.

Care of sow at farrowing

In farrowed sow 30% of piglets never reach weaning age and 5% extra mortality post weaning. Clean and disinfect farrowing pen (ammonium, iodoform or phenolic compounds) and provide light bedding, chopped straw and fresh drinking water. Reduce ration by 1/3rd till farrowing, bulky ration and withdraw feed 12 hrs before farrowing. Clean sow with lukewarm water and allow her to suckle young ones. Feed sow after 12 hrs of farrowing (slowly increasing the quantity). Check rectal temperature (if above 40.2°C, consult a veterinarian for appropriate treatment). An important disease during this period is Mastitis, Metritis and Agalactia (MMA) syndrome which is characterized by anorexia, lethargy, high fever, swollen udder, mucopurulent vaginal discharge. Antibiotics and multi-vitamin injections are recommended. Swab the udder with saturated solution of ferrous, zinc and copper sulphate.

Care and management of suckling sow

Sows are fed more for its body maintenance as well as milk production (2.5 to 4 kg of milk per day) to nurse piglets. A sow requires about 4 to 6 kg of feed daily depending on its nursing ability and litter size. Practically 1.5 kg of feed for sow and add 0.5 kg of feed per piglet (maximum 5 to 6 kg of total ration). Ten days after farrowing, sow may be allowed to graze along with its litter (Lucerne hay or

succulent fodder). Creep area: concentrate feed for piglets prevent sow from eating. Maize or other grains, groundnut cake, fishmeal, meat scrap, dairy products, etc. included in ration (14-15% CP) along with minerals and vitamins. Few days prior to weaning, quantity of feed is gradually reduced to restrict milk flow and dry out udder (to reduce complications like mastitis).

Care and management of piglets

Pen should be clean and hygienic to minimize disease occurrence. Piglets within few minutes of birth starts suckling and each piglet suckles to a particular teat and doesn't allow others. Weaker piglets starve, so need assistance.



Assisted feeding of piglets

Naval ill prevention: Naval cord tied off, cut 3-5cm distal to legation and dipped in 2% iodine solution or 70% ethyl alcohol.

Needle teeth cutting: Two pairs of sharp teeth on each jaw can irritate sow's udder during nursing or cause injury to another piglet. Needle teeth can be removed shortly after birth (0-3 days).

Creep feeding: Piglets begin to develop an appetite for dry feed at age of 2-3 weeks. Provision of high protein feed for growth and development. Small area fenced by sides to prevent sow's entry where piglets fed.

Piglet anaemia: Iron deficiency and anaemia are common in confined rearing (pasture reared piglets get iron from soil). Oral administration which consists of spraying and swabbing in sows udder with saturated solution of ferrous sulphate (0.5 kg of ferrous sulphate in 10L of hot water). Oral iron paste can be administered within 24 hrs of birth. Iron injection after 4 and 14 days of birth @ 1 and 2 ml (I/M) respectively.

Castration: Male piglets not selected for breeding castrated early (3-4 weeks of age) to prevent uncontrolled breeding. Fattening male pigs can be castrated to maintain quality of meat and to minimise unpleasant odour (boar taint) in pork.

Identification: Weaning is the ideal time for giving identification to piglets (Notching, Tattooing and Tagging). Notching: common method, at age of 10-15 days old. Tattooing: using tattooing forceps at inner side of ear devoid of blood vessels. Tagging: By plastic tags, brass tags or polyurethane tags. RFID (Radio Frequency Identification): Piglets are injected subcutaneously with microchips mostly in ear to make permanent marking and identified by microchip reader.



RFID microchipping

Deworming: Piglets dewormed at time of weaning or 1-2 weeks after weaning. Ideal drug to deworm piglets is which is Fenbendazole given @ 1ml/ 5 kg body weight.

Orphan piglets: Piglets become orphan when sow dies, or mother has scavenging behaviour, or mother suffers from agalactia (no milk in udder), mastitis (infection of udder) etc. Orphan piglets should be transferred to the sow with fewer piglets after masking them with a spray which has a strong smell (e.g., kerosene diluted with water). In non-availability of sow, orphan piglets can be hand fed with goat or cow's milk.

Weaning of piglets: Piglets should be weaned at an early stage (30 days of birth). Average weight of piglets at weaning is 5-7 kg. Normally piglets are weaned by weight not by date in farmers' field. At weaning, sow should be taken away from piglets not in the reverse way.



Recording of body weight in piglets

Grower management

Piglets kept for growth are grouped according to size and group size vary between 7-10 numbers. Optimum floor space provided to minimize tail biting and fighting among the groupmates. 16% crude protein is ideal for grower ration. Piglets drenched or fed with deworming tablets or liquids (Fenbendazole/ Piperazine) immediately after weaning to control internal parasites.

Care of breeding boar and sow

Sexual maturity attains in male pigs at 6-7 months of age, but they are used in breeding at 10-12 months of age to get better vigour and fertile sperm count for successful breeding. The males are fed after service rather than before mating with sow. Boars are dewormed before one week of breeding. Outdoor exercise is must. Boars are housed individually with 1.5-2.2 square meter close space. Generally, in farmer's field, Boar to Sow ratio should be 1:10. Optimum number of services are 2-4 per week. Mating in early morning or late afternoon is desirable. Rotational breeding is followed to avoid inbreeding in the flock.



Artificial insemination in farmer's field

Breeding system:

In pig breeding programs, the focus is on improving two overall traits, fertility and productivity. In the field condition farmers are not aware of systematic breeding and selection methods. Natural mating takes place which is completely random. There is the practice of interchange of breeding boars between the herds. Now artificial insemination is practised in the organised farm.

For breeding pigs, keep recently weaned sows and replacement gilts in proximity to boars, with pen layouts designed to facilitate ease of access for both personnel and animals during oestrus detection and mating. Ensure the mating area is sufficiently spacious to support all courtship and mating behaviour. Utilize non-slippery flooring, incorporating roughened concrete and additional sand or grit as needed. Remove any potential hazards, such as feeders or nipple drinkers that could cause injury. Mate animals of comparable sizes, and it may be advantageous to move the female into the boar's pen for easier removal post-mating. Supervise mating to ensure correct penetration into the vagina rather than the anus, and verify that the mating-ejaculation process lasts a minimum of three minutes; if it is shorter, repeat the mating. Promptly remove the female after the boar dismounts, unless the copulation was interrupted. Handle all animals with care and record all events with precision and immediacy.

Disease Management in Goya pig

The pigs of Goya variety exhibit strong disease resistance compared to exotic breeds. However certain precautionary measures should be taken to avoid incidence of infection diseases. Proper biosecurity management, deworming and vaccination for herd health management, proofing of pig sheds to prevent rodents, insects and other predators, etc. are required to keep the herd well maintained for profitable business. The occurrence of different diseases and their preventive measures are mentioned below.

Deficiency diseases: Mineral and vitamin deficiency occurs in pigs. So multi vitamin drugs like Groviplek, Vimeral, Ostovet, and Agrimin forte mineral mixture, etc. given as supplementary nutrition to the pigs.

Infectious diseases: Classical Swine Fever, African Swine Fever, Porcine Respiratory Reproductive Syndrome, Foot and Mouth Disease, Swine Erysipelas, Swine influenza, etc. causes severe disease and flock mortality. Proper biosecurity measures, vaccination for prevention and judicious use of Antibiotics for treatment is required to keep the pigs healthy and profitable pig farming.

External parasites: Mites bite and burrow into skin causing itchiness (mange). Ivermectin injection or chemical wash like acaricides (Amitraz) used to treat the animals. Lice causes scratching over skin and move freely, but less severe than mites. Insecticidal wash like Malathion or Coumaphos can be used to treat the pigs.

Ticks attach to skin and suck blood, but don't move. Chemical wash like acaricides (Amitraz) is used against ticks.

Vices in pigs: Pigs exhibit abnormal behaviour or vices like tail biting, ear biting, flank biting, snout biting, pen fouling, navel sucking, etc. Hence, the animals should be given proper space, isolation of aggressive animals, feeding with sufficient salt, etc. to avoid vices in pigs.

Vaccination in pigs: Newly born piglets should be vaccinated at an age of 2-3 months against Classical Swine Fever (CSF) and Circo virus diseases. Vaccine against Foot and Mouth Disease virus and H.S. is also recommended in pigs maintained near dairy farms. The vaccines against emerging diseases in pigs like Porcine Respiratory and Reproductive Syndrome (PRRS) and African Swine Fever are commercially available in some countries like Vietnam.

Stress management in pigs

Heat stress management: During hot summer days pigs show sign of open mouth breathing, vocalization (squealing), blotchy skin, stiffness, muscle tremor, increased heart rate, increased body temperature, etc. Animals become lethargic and decrease feed intake. Boars have reduced libido and less weight gain. External (high humid) and internal (low humid) sprinklers are used to make animals cool. Micro droplets of water from pressurized nozzle fall down that doesn't wet floors. Ventilating fans like ceiling fans, exhaust fans and paddle fans are used to pass out hot air inside the room. Wet curtains and air coolers in low humid area can also be used. Common wallowing pond should be prepared in open space in the campus to keep the pigs cool during hot summer. Roof can be painted with white paint on exterior side and black on inside. Provision of shades near pig houses by planting trees. Insulating materials like thermocool can be used below the roof. Reduce stocking density and provide cool drinking water. Avoid feeding and handling of pigs between 10 am to 4 pm. Supplement electrolytes and antioxidants through water supply. Increase dietary energy density. Minimise excess non-essential amino acids and fibre. Increase availability of antioxidants through diet.

Winter stress management: During cold stress, pigs show sign of shivering, coughing, sunken eyes, etc. Skin colour changes from white/ dark colour to reddish. Pneumonia and respiratory diseases commonly affect the animals. For winter stress

management, extra bedding of wheat or paddy straw, gunny bags are given to save the lives of piglets. Lighting the covered area to increase the room temperature. To make pig sty or shed warm, small hot box using plywood for walls and ceiling, and heat lamps from roof can be hanged. Warm food and water can be fed frequently and feed quantity can be increased to increase the body metabolism and feeding efficiency.



Winter management of farrowing sow and piglets

Monsoon stress management: Protection of pigs from inclement weather conditions during rainy season is of utmost importance. Moisture present on ground produces a lot of bacteria that can cause diseases. Parasitic worms are mostly seen in rainy season. Flies are also found in increased numbers in wet season which irritate pigs and reduce productivity. The rapid spread of diseases during rainy season should be prevented with proper hygienic measures, periodical deworming and pre-monsoon vaccination.



Artificial Insemination in Goya pigs

Artificial Insemination (AI) is an important reproductive technology to boost pig production, particularly the crossbred Goya pig production to meet the rising demand for pigs and pork. This technology provides unique opportunity for the rapid genetic improvement of pig germplasm. AI technology in pigs involves collection of semen from proven male pig, subsequent semen quality assessment and insemination of semen into a receptive female pig using artificial means. ICAR-CCARI has standardized the procedures for pig semen processing, liquid semen preservation at 15-18°C and insemination in indigenous and crossbred pigs. Breeding of crossbred pigs in the Institute pig unit is performed exclusively through Artificial Insemination. Following are the major advantages of AI technology in pigs.

Major advantages of Artificial Insemination

1. Rapid genetic gain is achieved through extensive use of semen of genetically superior boar
2. Widespread use of superior male germplasm to produce genetically upgraded piglets
3. Eliminates the cost of maintenance of breeding boar and breeding cost, allows small-scale farmers to keep a few sows without maintaining a boar
4. AI make selective breeding easier as semen from a proven boar can be easily transported to distant places and can be used for insemination of sows on a large scale
5. AI can help to greatly reduce the incidence of inbreeding, the breeding of closely related animals, which can result in low productivity and inferior offspring.
6. Avoids possible injuries on either the boar or the sow/gilt that may happen during mating

7. Mating of animals of different sizes is possible through A.I
8. Risk if sexually transmitted infectious diseases are reduced as well as entrants of diseases carrying animals is also reduced because there is no direct contact.

Boar training for semen collection

Male Goya pig needs to be trained for semen collection. For this, an artificial dummy sow or a sow in oestrus can be used as dummy sow . When boar is accustomed to mounting the dummy, semen collection must be performed with a fixed dummy in a designated collection area. The gloved hand method is the most satisfactory method for collecting semen from Goya pigs. The objective is to simulate the cervix in which the penis becomes interlocked during natural service. The stimulus for ejaculation is the pressure applied to the spiral portion of the penis. The ejaculate is collected directly in a disposable container with a gauze or filter, covering the opening to avoid the mixture of spermatic fraction and gel fraction during collection. It is then placed inside a thermos in order to maintain the temperature around 37°C. Once the semen is collected it must be taken immediately to the laboratory for its evaluation and processing.

Estrus or heat detection

In order to ensure success in artificial insemination one of the most important factors is the detection of heat. Right time to perform AI can be determined according to the onset of heat. Estrus detection is a simple technique, provided it is done correctly. Females should be checked for estrus twice (as close as possible to 12-hour intervals) daily. The most positive sign that a female is in estrus is the mating stance. This is when the female stands immobile, arches her back, and cocks her ears in response to a boar or back pressure test (standing heat). Other signs of estrus include swollen and red vulva, vulvar discharge, restless behavior, erect eras, peculiar grunt sound, frequent urination etc.



Fig. Red Swollen Vulva



Fig. Heat Discharge

Procedure for Artificial Insemination using liquid semen

Important requirements for AI in Goya pigs are good quality boar semen, semen pouch, AI Catheter or Spirette, lubricating jelly gel or paraffin oil, sterile cotton and Tr. Iodine, damp paper towel or sterile cotton. Step-wise procedure for AI is described below:

Step 1. Make sure the sow or gilt is in standing heat: One should not attempt to breed female Goya pig that is not in standing heat or estrus. Put weight on the animal's loin and watch her response to make sure that she is standing still. To confirm standing heat, look for secondary signs such as erect ear, sticky vulvar discharge, and an enlarged clitoris.



Step 2. Cleaning of external genitalia: Clean the vulva with damp cloth or sterile cotton so that no dirt is pushed into the reproductive tract during AI. When using a catheter for young females, lubricate the tip with non-spermicidal lubricating jelly.

Step 3. Insemination procedure: Slowly insert the catheter into the vulva, keeping the tip pointed upward and forward to prevent entrance into the ureteral orifice. The catheter should be inserted slightly in anti-clockwise direction and should slide easily through the vagina until it reaches the cervix. In some gilts or young females, resistance may be encountered about four inches inside the vulva. When the catheter cannot be pushed forward any further, begin to turn the catheter anti-clockwise until it will be locked or not turn any further.



Attach the semen pouch or bottle which contains 60 to 80 ml of processed semen to the catheter. Deposit the semen slowly. At least three minutes should be taken to empty the container completely and then remove the catheter by turning clockwise while gently pulling outward. Rubbing a female's underline and flank area during insemination can stimulate females to pull semen into the reproductive tract.

Timing of liquid semen AI in Goya pigs:

Success of AI method in Goya pigs is highly dependent on accurate estrus detection. Timing of inseminations is usually based on the time when estrus is first detected. In general, the optimal time to inseminate a female is prior to ovulation (0 to 24 hours before ovulation in sows and 0 to 12 hours in gilts). For Goya crossbred pig variety, it is recommended that gilts be bred at 12 and 24 hours, and sows be

bred 24 and 36 hours after first standing estrus. With once-daily heat detection it is recommended that both sows and gilts be bred every day when they exhibit standing heat. Since farmers cannot accurately determine the exact time of ovulation, performing at least two AI during estrus increases the likelihood that one will occur during the optimum time. If females are in standing estrus for three days, there may be some benefit to an additional (third) mating. It is extremely important, however, that females that have gone out of estrus not be inseminated because reproductive performance (conception rates) will be adversely affected.

References

Annual Report 2021. ICAR-CCARI, pp. 63.

Banik Santanu, Naskar Soumen and Gandhi R.S., 2017. Swine Genetic Resources of India, Directorate of Knowledge Management in Agriculture Indian Council of Agricultural Research New Delhi 110012 (ISBN: 978-81-7164-171-0).

Banik, S., Kumar, S., Das, P.J., Bharati, J., Kumar, S., Barman, K., Chakurkar, E.B., Sahoo, A.R. and Rajkhowa, S. (2020). Agonda Goan Pig- A Unique Pig Genetic Resource for coastal livelihood of Goa, Monograph/NRCP/2020, PP.

Chakurkar, E. B., Naik, S. S., Barbuddhe, S. B., Karunakaran, M., Naik, P. K., & Singh, N. P. (2016). Seminal attributes and sperm morphology of Agonda Goan pigs. *Journal of Applied Animal Research*, 44 (1), 130-134.

Chakurkar, E. B., Sahu, A. R., Naik, S., Chethan Kumar, H.B. and Gokuldas, P.P. 2021. Genetic evaluation of growth and reproductive performances of crossbred pigs reared under intensive system in tropical humid coastal climate. *Tropical Animal Health and Production*, 53: 243-452.

ICAR-NRC on Pig, Annual Report 2023. Published by Director, ICAR-NRC on Pig.

Newsletter 2021. ICAR – CCARI, Vol 23 (2) pp. 2-3.

Sahu, A.R., Gokuldas, P.P. and Naik, S. 2023. Performance evaluation of crossbred pigs reared in coastal ecosystem. In: Compendium of XVI Agricultural Science Congress 2023 and ASC Expo on “Transformation of Agri-Food systems for achieving sustainable development goals” held at ICAR-CMFRI, Kochi, Kerala, India, Pp: 239 (10-13 October 2023).

Sahu, A.R., Gokuldas P.P. and Naik, V.J. 2024. Genetic analysis of growth performance in crossbred pigs reared under intensive system in coastal climate. *In: Compendium of National Symposium on Animal production systems and its role in sustainable use of ANGR & XXI Annual Convention of Society for conservation of Domestic Animal Biodiversity held at NTR College of Veterinary Science, Gannavaram, Andhra Pradesh, India, Pp: 52 (15-16 Feb 2024).*

