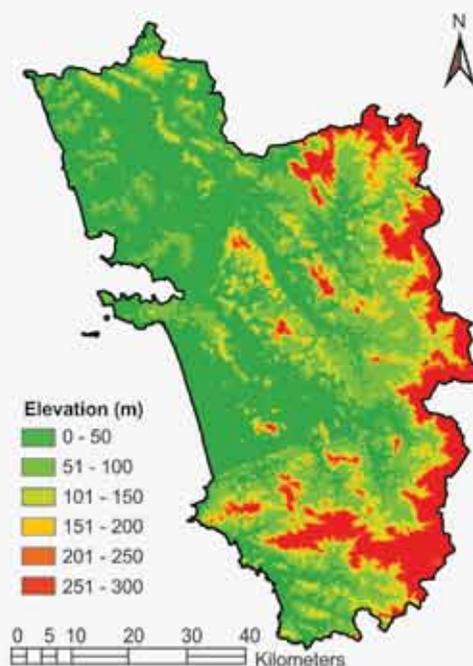


DOUBLING OF FARMERS INCOME BY 2022

Strategy Document for Goa



Indian Council of Agricultural Research
Department of Agricultural Research and Education
Ministry of Agriculture and Farmers Welfare,
New Delhi



Preface

The idea of creation of State Level Coordination Committees and the need for developing the State wise document for Doubling Farmer's Income (DFI) by March, 2022 was emerged during the ICAR Directors Conference held during 14-15 February, 2017 where Dr. Ramesh Chand, Member, NITI Aayog made presentation about DFI through various strategies.

For preparing the document of DFI by March, 2022 for Goa, the inputs received from Goa State Developments viz. Agriculture, Animal Husbandry and Veterinary Services and Fisheries, Horticultural Corporation, NABARD, Dr. BSKKV, Dapoli, ICAR- CMFRI, Cochin and also from progressive farmers such as Shri. Babu N. Komarpant, Shri. Ashok Joshi and Mrs. Deepti Joshi were immensely pertinent and valuable.

Also the data from Annual Reports and Vision Documents of the Institute, Potential linked credit plan of NABARD-Goa, Economic Survey of Directorate of Planning and Statistics, Goa, Vision documents of development departments of Goa, Potential technologies for doubling farmers income from ICAR-IISR, Kozhikode, ICAR-DCR, Puttur and ICAR-CPCRI, Kasargod and ICAR Policy document on Doubling Farmer's Income, ICAR-NIAP, New Delhi was very useful. The inputs from the presentation made by Dr. M.S. Swaminathan before the Hon'ble Prime Minister and also the presentation made at NITI Aayog, New Delhi, suggestions and inputs from Dr. Trilochan Mohapatra Hon'ble DG and Secretary (DARE) was also valuable in preparation of the final document.

The first State Level Coordination Committee meeting of DFI by 2022 was conducted on 27.3.2017 at ICAR-CCARI, Goa under the chairmanship of SSC (Director ICAR-CCARI, Goa) along with the members and other representatives. After considering the outcomes of the meeting as well as the inputs received from ICAR institutes in this region and Director ICAR-ATARI, Pune and Bengaluru various strategies are proposed for formulating the action plan.

As a Chairman of the Goa State Coordination Committee on DFI by March, 2022, it gives me immense pleasure to present the comprehensive action plan for Goa state and I thank all the contributors who have played significant role in bringing this document. I hope this document will help policy makers and planners to achieve the task of DFI.

The proposed action plan for Goa state include mainly the productivity improvement in major crops like paddy, cashew and coconut, diversification in agriculture, creation of integrated farming system models, mechanisation, value addition and policy reforms in agriculture.

Place: Old Goa

Date: 05.01.2018



(Lakhan Singh)

Convenor



(E B Chakurkar)

Chairman

Goa State Level Coordination Committee

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Background

Secretary (DARE) & DG, ICAR, New Delhi constituted Goa state Coordination Committees for doubling Farmer's income by March, 2022 with vide order no. F.No. 5-4/2017-Cdn (Tech), Dated: 6th March, 2017 under the Chairmanship of Director, ICAR-Central Coastal Agricultural Research Institute, Old Goa, North Goa-403 402.

As a Chairman of the Goa state coordination committee for formulating strategies on doubling of farmer's income by March, 2022, it gives me immense pleasure to present the comprehensive action plan for Goa state and I hope this document will help policy makers and planners to achieve the task of doubling the income of farmers.

The State of Goa comprises of two districts with a total geographical area of 3.61 lakh ha. Against the total area, 35% is under forests and 44% is gross cropped area. The economy of Goa is primarily driven by tourism followed by agriculture, animal husbandry and fisheries activities. Agriculture contributes to 3.74% of State GDP while secondary and tertiary sectors comprising of industries and services contribute to 80% of the GDP. The latest Agricultural Census report 2010-11 shows that there are 78020 land holdings and the average size of the land holding is 1.14 ha.

It is estimated in the 70th round of NSSO that the average income of farmers in Goa is Rs. 91,098 of which Rs.16,893 is through farming, 15,097 is through dairying, Rs. 12,243 through non-farm activities and 46,865 through wage labour and salary.

The first state level coordination committee meeting for doubling the farmer's income by 2022 was conducted on 27.3.2017 at ICAR-CCARI, Goa under the chairmanship of SSC and Director, CCARI, Goa. After considering the outcomes of the meeting as well as the inputs received from ICAR institutes in this region, various strategies are proposed for formulating the action plan.

The proposed action plan for Goa state include mainly the productivity improvement in major crops like paddy, cashew and coconut, diversification in agriculture, creation of integrated farming system models, mechanisation, value addition and policy reforms in agriculture.

Composition of State-wise Coordination Committee (SCC) for doubling Farmer's income by March, 2022 for the state of Goa

INDIAN COUNCIL OF AGRICULTURAL RESEARCH
KRISHI BHAWAN, NEW DELHI

F.No.5-4/2017-Cdn (Tech)

Dated: 6th March, 2017

OFFICE ORDER

Secretary (DARE) & DG, ICAR is pleased to constitute a State-wise Coordination Committees for doubling Farmer's income by March, 2022.

The composition of the Goa state Coordination Committee is depicted below:-

- | | |
|--|------------|
| i) Director, Central Coastal Agricultural Research Institute, Old Goa, North Goa-403 402 | : Chairman |
| ii) Director, ATARI, Zone VIII, Pune | : Convener |
| iii) Director, Agriculture, Govt. of Goa | : Member |
| iv) Director, Horticulture Govt. of Goa | : Member |
| v) Director, Animal Husbandry, Govt. of Goa | : Member |
| vi) Director, Fisheries, Govt. of Goa | : Member |
| vii) Director, CMFRI, P.B.No.1603, Ernakulam North-682 018, Cochin, Kerala | : Member |
| viii) Director CIFT, Matsyapuri-682 029, Cochin, Kerala | : Member |
| ix) Nominee of Secretary DAC&FW | : Member |
| x) Nominee of Secretary, DAHDF | : Member |
| xi) Nominee of Secretary, Ministry of Food Processing Industries | : Member |

The Chairman and the Convener of all the State Coordination Committees (SCCs) are requested to convene the meetings of their respective SCCs within March, 2017 and develop the concrete action plan for doubling the farmers' income for their respective states and share with the council in a time bound manner not later than 15th of April, 2017. The committees may study the existing productivity and income levels in the respective states, to develop strategy needed to double the income of farmers/ agricultural labourers by March, 2022. Area specific technology modules along with all possible combinations may be developed for various agro ecological sub-regions as well as for different socioeconomic backgrounds within the state. The approach towards doubling farmer incomes may focus on raising productivity and diversification into high-value agriculture as well as providing avenues for diversification of farm employment into non-farm high-income generating activities. The committees may also make clear-cut recommendations on the institutional mechanism to review and monitor implementation of the action plan to realise the goal and suggest midcourse corrections.

The Director, NCAP, New Delhi and the NITI Aayog documents/site may be consulted extensively while finalizing the action plan. Senior representatives from CGIAR system, commodity boards and the farmers' organisations may also be co-opted as additional members in the coordination committees wherever needed.

(S.P. Kimothi)

ADG-Coordination (Tech.)

Distribution:

1. All the Chairman and Members of the coordination committees.
2. All DDGs, ICAR
3. Sr.PPS to Secretary, DARE & DG, ICAR.
4. PPS to Additional Secretary (DARE) & Secretary, ICAR
5. ADG(PIM)
6. Director(F)
7. Information System Officer, DKMA, KAB-I, Pusa, New Delhi for placing the above office order on ICAR Website.
8. Guard file.

The participants of the meeting included below:

List of delegates attended the meeting	List of members absent for the meeting
Dr. E B Chakurkar, Director, ICAR- CCARI, Old Goa, Goa	Director, CIFT, Matsyapuri, Cochin, Kerala
Dr. DV Srinivasreddy, PS and Representative of Director, ATARI Bangaluru.	Nominee of Secretary DAC&FW
Dr. Santosh Desai, Director, Directorate of Animal Husbandry and Veterinary Services, Govt. of Goa	Nominee of Secretary DAHDF
Dr. Shamila Monteiro, Director, Directorate of Fisheries, Govt. of Goa,	Nominee of Secretary Ministry of Food Processing Industries
Shri. Ulhas Pai Kakode, Director, Directorate of Agriculture, Govt of Goa.	Representative from VC, UAS, Dharwad
Dr. Parag Haldankar, Associate Dean & Representative of VC, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (MH).	

Representative from NABARD	
Managing Director, Horticulture Corporation, Govt. of Goa	
Shri Babu N Komarpant, Progressive farmer on IFS from South Goa	
Shri Ashok Joshi, Progressive farmer of protected cultivation from North Goa	
Mrs. Deepti Joshi Progressive farmer as entrepreneur for value addition from North Goa	
Dr. Jayasree Loka, CMFRI, Karwar centre and Representative of Director, CMFRI, Cochin	
Scientists, ICAR-CCARI, Old Goa & PC, ICAR-KVK, North Goa	

Documents referred

1. Proceeding of the Goa state coordination committee (SCC) meeting on doubling of farmers' income by March, 2022 held at ICAR-CCARI, Old Goa, Goa on 27th March, 2017.
2. Annual Reports, 2015-16, 2014-15 and 2013-14, ICAR - Central Coastal Agricultural Research Institute Old Goa-403 402, Goa, India
3. N P Singh, B L Manjunath, S B Barbuddhe, V Arunachalum, Manohara KK and Manjulaxmi N, Research Achievements of 25 years, ICAR (RC), Goa, 2014.
4. B. L. Manjunath, B. K. Swain, Mathala J. Gupta, R. Maruthadurai. Agricultural Technology Options. Technical Bulletin No. 30, ICAR Research Complex for Goa (Indian Council of Agricultural Research), Old Goa-403 402, Goa, India. 2013.
5. Vision 2050, ICAR - Central Coastal Agricultural Research Institute Old Goa-403 402, Goa, India, 2015
6. Vision document 2030, Directorate of Agriculture, Govt of Goa, 2017.
7. Proceedings of Proceeding of brain storming session on Coastal Agricultural Research held on 09.04.2014 at ICAR-CCARI, Goa
8. Vision 2030, Directorate of Animal Husbandry and Veterinary Services, Govt of Goa, 2017.

9. Potential linked credit plan 2017-18- North and South Goa, NABARD Goa regional office, Panaji, Goa, 2017.
10. Technologies with Potential for Doubling Farmer's income by March, 2022 Suitable for the state of Goa: inputs from ICAR-IISR, Kozhikode
11. Technologies with Potential for Doubling Farmers' Income: inputs from ICAR-DCR, Puttur
12. Technologies with Potential for Doubling Farmer's income by March, 2022 Suitable for the state of Goa: inputs from ICAR-CPCRI, Kasaragod – 671 124, Kerala
13. Economic Survey 2016-17, Govt of Goa Directorate of Planning, Statistics & Evaluation, Porvorim- Goa

Broad objectives:

1. Production improvement in crops, livestock and fisheries
2. Crop Diversification, Intensification and Integrated Farming System (IFS) approaches (Integration of potential crops, animal and fishery) and advanced management practices like nutrient management and plant protection measures
3. Strategies for development of labour saving technologies through farm mechanization
4. Strategies for effective secondary agriculture means for addressing post harvest losses
5. Policy interventions in land reforms, community farming/contract farming, optimizing price of farm produce etc.

The State of Goa comprises of two districts with a total geographical area of 3.61 lakh ha. Against the total area, 35% is under forests and 44% is gross cropped area. The economy of Goa is primarily driven by tourism and mining followed by agriculture, animal husbandry and fisheries activities. Agriculture contributes to 3.74% of State GDP while secondary and tertiary sectors comprising of industries and services contribute to 80% of the GDP (@ current prices, 2015). Goa has impressive socioeconomic indicators, as compared to the other states of the Country. The State ranks 4th in the Country with 86% literacy rate as per the 2011 census and has the highest per capita income.

Socio-economic indicators of State of Goa

Parameter	District		Total/Average
	North Goa	South Goa	
Population	8,17,761	6,39,962	14,57,723
Human density (Number /km ²)	471	326	398.5
Livestock density (Number/km ²)	377	578	477.2
Forest area (km ²)	923	1296	2219
Forest cover (%)	53.17	65.92	59.54
Cropping intensity (%)	100.81	100.51	100.66
Land degradation (000 ha)	536.33	539.82	1076.15
Net sown area (000 ha)	76.8	54.4	131.2
Net irrigated area (000 ha)	15	20	35
Fertilizer consumption (kg/ha)	58	49	53.2
Rural female literacy (%)	82	80	81
Ground water availability (Hectare-meter)	8554	5989	14543

Goa, being in the tropical zone and near the Arabian Sea, has a hot and humid climate for most of the year with moderate temperature variation between 17 to 35°C. The month of May is the hottest, seeing day temperatures of over 35°C coupled with high humidity. The monsoon rains arrive by early June and provide a much-needed respite from the heat. Goa receives heavy precipitation (2500 to 3200 mm) and most of its annual rainfall is received through the South West monsoon which last till late September. Soils of Goa are mostly laterite (red coloured) with acidic soil reaction. The soils are deficient in soil available nitrogen, potassium, calcium, magnesium, zinc and boron and medium to sufficient in soil available potassium, iron, manganese, copper. The soils often have poor water holding capacity. Typical agricultural areas in the State

are upland and lowland. The coastal saline soils (locally called Khazan) is spread over about 18000 ha area.

Census report shows that there are only 31000 cultivators and 27000 agricultural labourers as compared to the total population of 14.58 lakh. Most of the farmers are not fully dependent on agriculture and they have supplementary sources of income through mining related activities, business, private or Govt. jobs and foreign remittances. It is estimated in the 70th round of NSSO that the average income of farmers in Goa is Rs.91,098 of which Rs. 16,893 is through farming, 15,097 is through dairying, Rs. 12,243 through non-farm activities and 46,865 through wage labour and salary. The major food crops grown in the state are paddy, cereals, pulses, oilseeds, sugarcane and vegetables. The important horticultural crops of the state are cashewnut, coconut, arecanut, mango, banana, pineapple and spices. Fishing is another important activity covering mainly marine fisheries. Inland fisheries is becoming popular considering the growing demand. The milk production is not sufficient to cater to the demand and is imported from neighbouring states. As such, there is good scope for animal husbandry activities. Community dairy scheme introduced by the State Govt. for large scale integrated dairy development is expected to give a big boost for the dairy sector.

The marginal or small farmers of the region have very limited land which is getting further fragmented with each generation and therefore farm enterprises requiring less land but higher productivity and employment opportunities, needed to be integrated with crop production. A judicious mix of one or more intercrops along with the main crop has a complimentary effect through effective recycling of wastes and crop residues and encompasses additional source of income to the farmers. These systems are often less risky, if managed efficiently, they benefit from synergisms among the crops, diversity in produce, and environmental soundness. Further, integration of allied enterprises in the system adds profitability and stability with intermittent returns through better recycling of resources.

a. Agro-ecologies in the state

The two districts of Goa fall under agro-ecological region 19. Western Ghats and Coastal Plain, hot humid-per humid eco-region (E2BA5). Further, there are two agro-ecological sub regions - 19.2 Central and South Sahyadris, hot moist subhumid to humid transitional ESR with deep, loamy to clayey Red and Lateritic soils, low to medium AWC and LGP 210-270 days (E2Cm/ B7(9) and 19.3 Konkan, Karnataka and Kerala Coastal plain, hot humid to per humid transitional ESR with deep, clayey to loamy acidic coastal alluvium-derived soils, low AWC and LGP 240-270 days (R7A(B8(7)). Rice is predominantly grown in three types of areas in Goa - morod or uplands, kherlands or midlands and khazan lands or saline lands.

b. Land use and cropping pattern

The land utilisation statistics for 2015-16 depicts that out of total 3,70,200 ha geographical area of the State, the gross cropped area was 1,56,462 ha while the net area sown was 1,30,109 ha (35%). The area under forest was 1,25,473 ha. (33.89%) land not available for cultivation was 37,137 ha (10.03 %), other uncultivated land was 38,557 ha (10.42%) and fallow land 13,976 ha. (3.78%)

Operational holding and areas as per agricultural census 2010-11

Size class	Number of operational holdings (ha)	Area of operational holdings (ha)	Average size of holding (ha)	
			2005-06	2010-11
≤ 1.0 ha	59900	28103	0.29	0.47
1.0-2.0	9817	17591	1.24	1.79
2.0-4.0	5707	16770	2.51	2.94
4.0-10.0	2010	12378	5.70	6.16
≥10.0	586	14152	66.99	24.15
Total	78020	88994	1.15	1.14

(Source: Economic Survey of Goa, 2016-17)

According to the Agricultural Census, 2010-11 there were in all 78,020 operational holdings covering an area of 88,994 hectares. There were 52,821 operational holdings covering an area of 60,742 hectares during the Agricultural Census 2005-06. Thus, there was an increase of 48 percent in the number of operational holdings and increase of 47 percent in the area during the 2010-11 Census, as compared to the Census of 2005-06. The average size of holding for the State which was 1.15 ha. in 2005-06 is 1.14 ha in 2010-11.

c. Natural resource endowments

Major crops and area under cultivation is presented below,

- Field crops: Rice, pulses (cowpea, moong), sugarcane, etc
- Plantations - Coconut, cashew, arecanut, oil palm, etc
- Fruit crops: Mango, banana, pineapple, jackfruit, etc.
- Spices: Black pepper, nutmeg, kokum, turmeric, cinnamon, ginger, etc.
- Tubers: Colocasia, Elephant Foot Yam, sweet potato, etc.
- Livestock: Dairy cattle, pig, poultry, buffalo, rabbit etc.
- Fisheries: Pelagic fish, demersal fish, crustacean and molluscan species, etc.

Water resources of the State: It is estimated that the State's total projected water requirement by 2051 A.D. could be about 8,030 mcm. As against this requirement, the total surface water resources that can be conserved is projected at 1,585 mcm. The Central Ground Water Board (CGWB), in their report on 'Dynamic Ground Water Resources of Goa State March, 2011 have estimated the available ground water sources

in the State as 14543.31 mcm and the net annual draft as 41.13 mcm. The stage of ground water development is 28%, which falls in the safe category of groundwater exploitation. Under Minor Irrigation schemes, irrigation potential to the tune of 30,532.95 ha has been created, out of which 260.00 ha have been created upto September, 2016. Potential utilized is 25,769.60 ha.

Rivers of Goa: There are nine major rivers in Goa flowing from East (Western Ghat) to West (Arabian Sea) except Sal River. Terekhol, Chapora, Baga, Mandovi, Zuari, Sal, Saleri, Talpona, Galgibag are the main nine rivers of Goa. Among these rivers, Mandovi and Zuari drain 2553 sq. km, about 70% of the total geographical area of Goa. Out of nine rivers, six originate and flow exclusively within the state boundaries and do not have any interstate implications. However, river Terekhol and Chapora originate in Maharashtra state while Mandovi originates in Karnataka. These rivers form an integral part of Goan life because of their portability, irrigation facilities, agriculture and coastal resources, transportation of mining ores, etc. Goa's rivers are unique and are both tidal as well as Rainfed. In Goa, during monsoon, water within the watershed areas is drained out through the major rivers to the sea. The rivers are influenced by the tidal influx upto the distance of 40 km inland towards upstream. Salinity factor in the river varies sharply during monsoon and non-monsoon seasons and so does the physico-chemical quality of water in wells along the riverbanks.

River Basin in Goa	Basin Area in Sq. Kms.
Terekhol	71
Chapora	255
Baga	50
Mandovi	1580
Zuari	973
Sal	301
Saleri	149
Talpona	233
Galgibag	90
Total	3702 Sq. Kms.

(ENVISGOA 2017)

d. Important development indicators

- i. Area, production and productivity improvement in crops, livestock and fisheries
- ii. Income generation from agriculture
- iii. Agricultural contribution to the state's GDP
- iv. Employment generation in Agriculture
- v. Entrepreneurships in agriculture and allied sectors
- vi. Import and export trend of agriculture and allied products
- vii. Agriculture credit growth
- viii. Agriculture and allied institutional growth

3

Infrastructure for Agriculture and Government Programmes

Goa state has various agriculture infrastructure essentially required for improvement of agriculture.

1. Agricultural Produce Market Committee (APMCs)
2. Goa Bagayatdar Sahakari Kharedi Vikri Saunstha Maryadit
3. Goa State Cooperative Milk Producers' Union (Goa Dairy)
4. Goa State Horticultural Corporation Ltd. (GSHCL) provides vegetables and other essential commodities at subsidized rates through its 855 outlets throughout the State. The commodities and three vegetable items are supplied by 14 mobile vans regularly at over 350 locations all over State once in two weeks. Since September 2013, GSHCL provides fruits at competitive rates.
5. National Mission on Micro Irrigation
6. E Krishi project
7. Western Ghat Development Programme (WGDP)
8. Soil Health Card Scheme
9. Special Component Plan (SCP) and Tribal Sub Plan (TSP)
10. Rashtriya Krishi Vikas Yojana (RKVY)
11. Coconut Development Board
12. Krishi Vikas Kendra
13. National Mission for Sustainable Agriculture (NMSA)
14. Sub Mission on Agriculture Mechanisation
15. National Mission on Agriculture Extension and Technology
16. The central sector crop insurance scheme namely "Pradhan Mantri Fasal Bima Yojana (PMFBY)" is being implemented in State of Goa from Kharif Season 2016 for the notified crops viz Paddy, Pulses, Groundnut and Sugarcane for the notified areas. The Centrally Sponsored Scheme Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) for components viz Per Drop More Crop, Other Interventions and Watershed Development has been implemented with a financial provision of Rs. 200.00 lakh.
17. National Food Security Mission
18. Agro Processing units
19. Dairy development schemes: State Govt. is implementing 9 schemes for dairy development, viz., Sudharit Kamdhenu Scheme, Revised modern dairy scheme, Scheme for cattle feed subsidy, Scheme for incentives to milkproducers, Pashupalan scheme, Green fodder scheme, Dairy equipment Scheme, Infrastructuredevelopment Scheme, Community Dairy scheme and Dairy kits Scheme.

4

Productivity Gaps and Major Constraints

Productivity Gaps

The average productivity of main crops of Goa with national average is furnished below

Crops	Productivity in Goa	National Productivity
Rice (kg/ha)	2783	2404
Groundnut (kg/ha)	1300	757
Sugarcane (kg/ha)	54350	71095
Coconut (Nuts/ha)	4976	10614
Arecanut (kg/ha)	1630	1558
Cashew (kg/ha)	420	753

Problems/Constraints faced by farmers in Goa state

- Unavailability of quality seed and planting material of paddy, cashew, coconut and other important crops
- High labour cost and unavailability of harvesters in coconut and other areas of agriculture
- Wild animal menace in agriculture is important and major problem in Goa
- Lack of cold storage and warehouses, small scale paddy processing units
- There is a wide gap between demand and production of milk, meat and eggs in Goa which is currently depends on neighbouring states.
- Unavailability of quality feed and fodder for dairy sector
- Lack of capacity building of farmers, youth, field veterinarians about improved animal husbandry practices
- Presently, there is an acute shortage of Field Veterinarians and Veterinary Assistants at all field establishments which limit better veterinary services to the farmers.
- Unavailability of labour in poultry, dairy and other animal husbandry sectors
- Lack of slaughter houses/meat processing units for small animals (goats, pigs and poultry) for meat production and value addition.
- Unavailability of quality seeds in fisheries sector is a major concern. Besides, storage facilities, lack of awareness about advanced technologies, lack of proper marketing chain and facilities are also matter of concern.
- Establishment of coastal zone coordination agriculture committee minimum support price
- Lack of coordination among different government departments.
- Facility /data of kisan card should be made valid for availing all the schemes of development departments to get support in terms of subsidy/support price etc.
- Farmers also expressed issues like capacity building of weaker sections, attracting youths to agriculture, and publications of success stories, providing agriculture inputs and providing facilities for by products processing.

Horticulture

Goa is primarily a horticulture state due to more than 60 per cent cropped area under horticultural crops. The major being the cashew (37% of cropped area) followed by coconut, arecanut, pineapple and other fruits followed by black pepper, oil palm, rubber and vegetable crops. But of late Government of Goa is promoting protected cultivation of high value flower and vegetable crops viz., gerbera, orchids, anthurium, capsicum, cucumber etc. There are more than 100 naturally ventilated polyhouses with an area ranging from 500 to 2000 m². In addition, there is vast scope for exotic fruits crops viz., mangosteen, durion, avocado, rambutan etc. followed by cut foliage and other exotic flower crops like heliconia spp, ginger groups etc. At ICAR-CCARI, Old Goa, the study on evaluation of heliconia types as inter crop in coconut has indicated that different heliconia types can be cultivated successfully as inter crop in coconut with an additional income of Rs.50,000 to Rs.75,000/ha depending on the heliconia variety. The successful model has already been demonstrated in farmer's field with perceptible income generation. Since, heliconia is the most suitable crop for the coastal region, it can be exploited for floriculture purpose in other west coast states like Maharashtra, Karnataka and Kerala

Sector wise potential

Floriculture: The western region of India has got high potential for cultivation of cut flowers and locally available flowers. Huge diversity exists in jasmine, crossandra and other flower species endemic to the region. Floriculture is highly neglected in Goa and accounts for less than one per cent of total horticultural crops. As per rough estimates, Goa has hardly 25 hectare of area under floriculture with the production of 40 tonnes per year. Considerable amount of flowers are brought to Goa region daily for its requirements from neighbouring states. There is an opportunity to develop floriculture industry in the region to make the 20 Indian Council of Agricultural Research region self-sufficient in meeting the demands created by the tourism and seasonal festivals.

Spices and Condiments: Major spices like black pepper, clove, nutmeg, cinnamon, ginger and turmeric are economically important crops in both east and west coast regions which contribute significantly to the National economy for domestic and export purposes. Opportunities can be encashed for enhancing the production and productivity of these 91 high value crops through novel varieties and production technologies in the light of climate change environment. Secondary agricultural activities will have abundant scope in the region. Nutmeg is one of the economically important tree spice crops suitable for commercial cultivation in Goa. Abundant seedling progeny exists in arecanut mixed cropping systems. Potential local germplasm stock of nutmeg needs to be identified, collected, evaluated and conserved for posterity. Scope for evaluating the promising nutmeg genotypes as intercrop in coconut gardens is enormous and needs

to ensure it as a compatible tree spice crop component in coconut garden, besides introduction of other spice crops like cinnamon and black pepper. There is high degree of variability in chillies grown in Goa.

Secondary Agriculture: Reduction in the availability of labour for agriculture has made the timely execution of agriculture operations difficult. Therefore, there is an opportunity to reorient the priorities towards high value agricultural products and value addition to the produces. The potentialities for agro-based or bio-based industries have not been realized. Agro-industrial potentialities of crops such as ginger, turmeric, cinnamon, tuber crops such as tapioca, yams, sweet potato, can be used as a source of carbohydrate, starch and protein. Medicinal plant resources: The region is very rich in medicinal plants. Medicinal plant species of Western Ghats represent a variety of life forms ranging from lichen, algae, herbs, shrubs, climber and trees, which are annuals to perennials. The auto-ecology and syn-ecology of medicinal plant species is complex and their proper understanding requires a sound knowledge of the ecology, taxonomy and ethno-botany for these species. Western Ghats with its species diversity is a treasure house of different kinds of medicinal plants. The limited knowledge on the varied use of the medicinal plants, their availability and extent of distribution weakens the ways to utilize these resources efficiently.

Agro ecotourism

There is a great scope to develop and promote agro-eco tourism. The earlier thinking of beach based tourism is now fast changing with pressure on land (ON SHORE). The vast forest areas are being brought under cultivation of various agricultural/ horticultural crops due to alarming pressure on land in recent years. Agro-eco-tourism as an enterprise: As a supplementary enterprise, agro-tourism could be a minor activity that would support the other products on your farm. For instance, if your primary enterprise is livestock production, you may decide to invite school groups to your farm several days a month to learn about your animals and your occupation. Occasionally hosting guests on your farm would make agro-tourism a supplementary enterprise to your primary enterprise as long as the agro-tourism activities were a minor part of your farm product mix.

Livestock

Livestock production in Goa state is gaining potential due to facilities like government schemes and increasing demand of milk, meat and eggs. Dairy, piggery, poultry and goat farming are emerging as a small to medium enterprise and also livestock rearing is part of integrated farming system.

Dairy sector: Milk requirement of Goa state is 3-3.5 lakh litres per day but current milk production is about 1.5 lakh litres per day. Therefore, there is wider scope in dairy sector to boost the milk production. There are constraints of fodder production for livestock but area expansion for growing fodder can mitigate this problem. The State faces shortage of green fodder (450 MT) and dry fodder (235 MT). Wastelands and Forest lands may

be utilized for cultivation of green fodder. Green fodder production as intercrop in existing plantations need to be promoted. Dry fodder needs systematic production, preservation, etc. Subsidy scheme for dairy animals needs to be compulsorily linked to fodder production. There is no feed mixing unit in North Goa. The cost of production is high due to non-availability of raw materials for feed, such as maize, bajra, which if cultivated locally, would reduce the cost of production. Incentives need to be given for cultivating cattle feed ingredients. Maintaining dairy animals along with fodder production and localized feed mixing could supplement farmers' income by reducing costs. A two animal unit providing average of 20 litres/day could fetch net returns of at least ₹1 lakh per year.

Goat production potential: The population of goat breeds in Goa is about 13,000 and there lies a great demand for chevon (Goat meat) due to growing tourism and awareness of goat meat. The tourist population as well as the opportunity for export of meat offers immense scope for rearing goats in this state. Konkani Kanyal and Osmanabadi are the popular breeds in this region but present in a limited number. Konkani Kanyal goat is a meat type breed adapted to high rainfall and hot and humid climate of Goa. Introduction of Konkani Kanyal goat breed under scientific stall feeding can boost goat production in Goa state. At six month age, the female goats weigh up to 34 kg and males up to 38 kg.

Pork production potential: In Goa due to tourism industry, plenty of hotel/ food wastes available round the year and farmers use the hotel wastes for feeding their pigs with low or nil expenditure. Agonda Goan pig is the recognized pig breed of Goa state is known for its adaptability to the climatic conditions of Goa such as heavy rainfall, hot and humid conditions and these pigs are also famous for their meat quality suitable for sausage preparation.

Poultry potential: There is huge demand for poultry eggs and meat in Goa. The per capita poultry consumption in Goa is estimated at about 80 eggs and 3 kg of meat as against the national average of 55 eggs and 2.2 kg of meat. This may be mainly due to large number of tourist inflow. The demand for poultry products is 150,000 broilers per week, and local supply is just one third of the demand. As per the Livestock census, 2012, there are 2,92,000 poultry birds (including backyard poultry, poultry farm birds, ducks, turkey, etc.), of which 1,04,969 poultry birds are in South Goa and 1,86,982 poultry birds are in North Goa. Back yard poultry is slowly getting a presence in the State as a household activity as both meat and eggs have local preference and fetch better sale price.

The retail poultry market is well established due to heavy demand from the locals and tourists. But, there is a need to develop hi-tech and environmentally safe, automated poultry dressing units. As per rough estimates, the poultry demand of the State is 6087 MT/year, while the local production is 1050 MT (2015-16). The egg demand of the State is 1623 lakh per year, while the supply is 352 lakh /annum (2015-16).

Meat, poultry and milk production in Goa state for last five years

	Meat (000 Tonne)	Milk (000 Tonne)	Egg (Lakh Nos.)
2011-12	10.08	60.00	15
2012-13	8.29	61.24	46
2013-14	5.00	67.81	59
2014-15	7.85	66.60	75
2015-16	7.88	54.34	35

Fisheries

Fishing is one of the major economic livelihoods of the fishermen in the State and fish is the staple diet of a major section of the Goan population. Total fish catch during 2015-16 is 1,11,911 MT which is about 5% less than the previous financial year. Of this, marine catch is 1,07,069 MT and inland fish catch is 4,842 MT. Fish exported during 2014-15 is 44,684 MT (value Rs. 569.54 cr.) (Source : Dept. of fisheries)

There is good potential for fresh water fish/prawn culture in about 115 fresh water perennial and seasonal bodies with an area of 1,585 ha including Anjunem Reservoir and Mayem lake. North Goa has around 2,000 ha marshy and Khazan land suitable for shrimp farming. Mussel, oyster and crab culture hold potential in saline backwaters and mangroves. The State Govt. has set up a diagnostic laboratory in collaboration with ICAR / NIO to ensure sustainable eco-friendly aquaculture under Brackish Water Development. The scope and potential of fisheries sector is as follows to increase the income of farmers

1. Promoting aquaculture in inland and brackish water areas on a mission mode.
2. Focus on improving fishing infrastructure – Jetties, Ramps, Landing Centres.
3. Focus on low value fish utilization and value addition
4. Focus on utilizing the full potential of inland fisheries through aquaculture
5. Diversification to aquaculture, mariculture using cage culture in open water bodies.
6. Effective use of mangroves through crab culture.

Fish production for the last five years for Goa state (2012 to 2016)

Year	Inland fish production (lakh tonnes)	Marine fish production (tonnes)	Total (lakh tonnes)
2012	0.87	3887	0.91
2013	0.88	4678	0.93
2014	1.28	3718	1.32
2015	1.08	4648	1.13
2016	1.01	4403	1.05
2015	1.08	4648	1.13
2016	1.01	4403	1.05

The potential production from different fisheries sectors with their production, utilisation are presented in the following table for Goa state

Fisheries sector	Production (t)	Utilisation	Potential (t)
Freshwater aquaculture (0.015 lakh ha ponds and tanks)	100-200	2-4%	10000
Marine fisheries	90000	80-90%	1,00,000
Mariculture (100 km with bays and lagoons)			2000
Brackishwater aquaculture (330 ha)	50-60	10%	1000
Inland capture fisheries (0.13 lakh ha)	4000	70-80%	6000

Options for improvement

- 1) Enhancement of fisheries resources for livelihood improvement through coastal mariculture in coastal waters of Goa using finfish and shell fish culture and freshwater aquaculture technologies
- 2) Design, construction and deployment of artificial fish habitats in coastal waters of Goa for enhancement of fishery resources
- 3) Dissemination of technologies for production of ornamental fish seeds for improvement of ornamental fisheries sector of the state
- 4) Fish based integrated farming system with agricultural, horticultural and animal components for improvement in agricultural productivity
- 5) Dissemination of potential fishing zone advisories for improvement in precision fishing and enhancement of fisheries resources
- 6) Empowerment of fishermen with efficient and eco-friendly fishing gear materials to improve sustainability in fishing operations
- 7) Improvement in marketing efficiency for fisheries resource using value addition and state regulated marketing channels

Agro forestry potential

1. Refinement of traditional agro forestry systems (Kulagars) on sound scientific based
2. Promoting of agro forestry systems including components like bamboo, timberwood (teak, champaa, rosewood etc) and fruit trees like jackfruit and jamoon trees coupled with apiculture entrepreneurship
3. Promoting of Silvi pastoral agro forestry systems for sustainable use of natural resources

Post harvest processing potential

1. Promoting of agro based industries (cottage/rural scale) for primary and/or secondary processing of farm produce for value added products with special reference to local important fruit crops like jackfruit, kokum and spices
2. Establishment of units for value addition in Dairy milk products and pork and mutton products

6

Role of Technology

Strategy and action plan for enhancing production, cost reduction, quality improvement, generating additional income

Strategies:

1. Productivity improvement in crops
2. Crop Diversification, Intensification and Integrated Farming System (IFS) approaches (Integration of potential crops, animal and fishery) and advanced management practices like nutrient management and plant protection measures
3. Production improvement in animal and fishery sector
4. Mechanization in agriculture and allied activities
5. Creating value chain-supply network by Post-Harvest management and Value addition

1. Productivity improvement in crops

Crops	Strategies	Action plan				
		2017-18	2018-19	2019-20	2020-21	2021-22
Paddy	Introduction of High Yielding Varieties (HYV): Area coverage in %	10	20	30	40	50
	Increasing the Seed Replacement of Ratio (SRR) of existing popular varieties-SRR rate in %	20	40	60	80	100
	System of Rice Intensification (SRI)- Area expansion in %	5	10	15	20	25
	Certified seed production of HYV as an enterprise-Quantity in quintal (q)	20	50	100	200	500
Cashew	Replacement of senile plantation with HYV (% area to be covered)	5	10	20	30	40
	Nutrient management (INM and IPM) in cashew. (% area to be covered)	5	10	20	30	50
	High density planting of HYV (Area in hectares)	5	10	20	30	40

Mango	Creation of new orchards of improved local varieties by high density planting (Area in hectares)	5	10	20	30	40
Coco-nut	Introduction of Dwarf – HYV in coconut (Area in hectares)	10	20	30	40	50
	Inter cropping management – Forage / Spices / Fruits / Floriculture (Area in hectares)	10	20	30	40	50

2. Crop Diversification, Intensification and Integrated Farming System (IFS) approaches (Integration of potential crops, animal and fishery) and advanced management practices like nutrient management and plant protection measures

Crops	Strategies	Action plan				
		2017-18	2018-19	2019-20	2020-21	2021-22
Utilization of rice fallow lands for pulses like cowpea, green gram (Mung) & Ground nut (Area in hectares)	Area expansion under paddy fallow lands	2000	5000	8000	10000	12000
Vegetables	Introduction of varieties along with production and protection technologies (area in hectares)	50	100	150	200	250
High value Horticultural crops and spices	Introduction of varieties along with production and protection technologies (area in hectares)	50	100	200	300	500
Creating models of IFS in farmer field with different components (in numbers)	IFS models in South and North Goa with best components	10	15	20	25	30

3. Production improvement in animal and fishery sector

Dairy sector

a. Area expansion under green fodder production.

Crops	Strategies	Action plan				
		2017-18	2018-19	2019-20	2020-21	2021-22
Green fodder production	Area expansion of green fodder cultivation through extension activities and schemes	2,000 ha	2000 ha	2000 ha	2000 ha	2000 ha
Advance technology like Hydroponic fodder for landless farmers	Demonstration and establishing models in field	10 in each Talukas	20 in each Talukas	50 in each Talukas	100 in each Talukas	200 in each Talukas

b. Breeding policy.

- i. Introduction of exotic germplasm through AI not exceeding 50% genetic makeup For high yielding, crossbred dairy cattle may be promoted but not exceeding exotic blood level more than 50%. Replacement of stock at least 10 % with units can improve the production.
- ii. Introduction and conservation of Indigenous breeds: In the scenario of climate change it is very much essential to identify and conserve local germplasm of cattle suited for local coastal climate. Through selective breeding and purifying local breed development is essential. The indigenous high yielding breeds of Indian continent also needs to be introduced as per requirement of farmers.
- iii. Community Dairy Farming: For creating self-employment and to engage youth in dairy farming community dairy farming concept will be useful.
- iv. Organization of cattle markets for facilitating sale/purchase of high quality breeding animals of farmers among themselves.

Dairy cattle	Strategies	Action plan				
		2017-18	2018-19	2019-20	2020-21	2021-22
	Introduction of exotic germplasm through AI not exceeding 50% genetic makeup (number of crossbreeds)	5000	5000	5000	5000	5000

	Introduction of indigenous breeds: Gir, Sahiwal and Red Sindhi (Number of cows)	5000	5000	5000	5000	5000
	Community dairy farming (numbers)	10	20	30	40	50
	Cattle markets (each in district)	Nil	01	01	Nil	Nil

c. Meat

- i. Introduction of improved breeds in Goats, Pig, Poultry.
- ii. Slaughter house and meat processing units for small animals.
- iii. Strengthening the veterinary services.

Improvement in Meat and egg production	Strategies	Action plan				
		2017-18	2018-19	2019-20	2020-21	2021-22
Goat	Introduction of coastal goat breeds (Konkan Kanyal) under stall feeding (number of breeding units in farmer's field and govt.\units)	10	20	30	40	50
Pig	Introduction and conservation of indigenous and cross breed pigs (number of pigs)	10,000	10,000	15,000	15,000	15,000
Poultry	Improvement in backyard poultry and coloured broilers for meat and egg production (Number of poultry)	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000

4. Mechanization in agriculture and allied activities

Mechanization in agriculture and allied activities	Strategies	Action plan				
		2017-18	2018-19	2019-20	2020-21	2021-22
	Mechanisation of Land preparation, planting and harvesting (Area covered in %)	15	20	30	40	50
	Mechanization in coconut harvesting (Area covered in %)	10	15	20	25	30

5. Creating value chain-supply network by Post-Harvest management and Value addition

Value addition in agriculture and allied activities	Strategies	Action plan				
		2017-18	2018-19	2019-20	2020-21	2021-22
Paddy	Establishment of community agro- processing centres (in numbers)	2	4	6	8	10
	Establishment and promotion of storage structures					
Coconut	Establishment of processing units for virgin coconut oil and other products (in numbers)	2	4	6	8	10
Cashew	Cashew apple value addition including feni	2	4	6	8	10
	Cashewnut value addition					
Other fruits/ crops	Establishment of community multi product processing plants for value addition of Kokum, Jackfruit, Breadfruit, Jagoma, Wax Apple, Jamun Karonda, star fruits, etc. (in numbers)	2	4	6	8	10

Dairy and meat products	Establishment of units for value addition in Dairy milk products and pork and mutton products(in numbers)	1	2	3	4	5
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Fisheries sector

- There is a wide scope to improve the income and livelihood of fishermen through diversification of fish species to increase stock density, better availability of the fish seeds, promotion of mussel farming, capacity building and awareness creation, etc.
- Improved storage facilities – cold ice plants, insulate vehicles, etc can also play an important role for marketing of the fish catch.
- Development of integrated farming systems with fishery as an important enterprise can ensure regular income and improved production.
- Post-harvest handling, value addition, allied activities like ornamental fish farming also have potential to contribute to improvement in income.
- Improved technologies like cage culture technology, satellite hatcheries for raising cultures can help farmers to increase their fish catch.
- Providing subsidized cages and ensuring timely and adequate supply of fish seeds to the farmers are essential to boost farmer's income.
- Fish production strategies like diversification of inland fish production through new finfish species and methodologies and promotion of ornamental fish culture through self-help groups

Potential contribution to farmers income and strategy for scaling out these technology (Technology information/packages validated/successfully demonstrated be included as examples to be replicated in different agro ecologies)

Technologies/packages validated by ICAR-CCARI, Goa

Sl. No.	Technology Title	Brief Description (not more than 200 words)	Potential income increase/impact due to adoption of technology (in %)
1.	Soil and Water Conservation technologies on Sloping Land for fruit and plantation crops	<ul style="list-style-type: none"> In cashew, Continuous contour trenches with Stylosanthes scabra and Vetiveria zizanioides reduced runoff by 44.5% under 4 m × 4 m spacing. 	<ul style="list-style-type: none"> Continuous contour trenches with Stylosanthes scabra and Glyricidia maculata reduced runoff by 46.3% under 6 m × 6 m spacing Highest Soil and Water Conservation -49.5 % (4 m × 4 m) and 62.9 % (6 m × 6 m)
2	Biological control for plant health management in Coastal regions.	<ul style="list-style-type: none"> Application of talc formulation of bacterial antagonists in nursery (50g/m²) and while planting (1.25g/plant) reduced the incidence of bacterial wilt in brinjal. Application of talc formulation of Trichoderma to the seedlings (1.25g/plant) reduced the incidence of Fusarial wilt in watermelon. Application of talc formulation of bacterial antagonists and Trichoderma during planting (50g/plant/year) reduced the incidence of foot rot in black pepper. Application of talc formulation of bacterial antagonists in nursery (50g/m²) and while planting (1.25g/plant) reduced the incidence of soil borne diseases in chilli. Application of bio agents improved the growth and increased the yield in the above crops. 	<ul style="list-style-type: none"> Brinjal: Disease reduction (50-70% over control); Yield increase (40-70% over control). Watermelon: Disease reduction (60-80% over control); Yield increase (24-27% over control). Black pepper: Disease reduction (80-90% over control). Chilli: Disease reduction (40-50% over control).

3	<p>Heliconia as inter-crop in coconut makes coconut farming more profitable in Goa</p>	<ul style="list-style-type: none"> • Heliconia- an exotic introduced flower crop performed extremely well under coconut plantation for three years. The study included 45 varieties of heliconia under coconut garden for various vegetative and floral characters. The flowers were supplied to the market and the feedback from the market is documented to short list the most promising heliconia types with high floral value. 	<ul style="list-style-type: none"> • In a one hectare of land with coconut alone can give an income of Rs. 1,75,000/- with a net profit of Rs. 1,00,000/year • Introduction of heliconia as an inter crop in coconut can fetches an additional income of Rs. 50,000 to Rs.75,000/- per year by selling flower, suckers and leaves depending on the variety of heliconia. • Hence the total income from one hectare of coconut with heliconia would be in range of Rs. 2.25 lakhs to Rs.2.50 lakhs per year compared to Rs.1.75 lakhs per year under coconut alone.
4	<p>Turmeric production Technology for Goa</p>	<ul style="list-style-type: none"> • Improved turmeric varieties were introduced, evaluated and standardized commercial production under Agro-climatic conditions of Goa which eventually resulted in recommendation of improved varieties like Prabha, Pratibha, Kedaram, Alleppey and Megha turmeric -1 for commercial production. Production technology is standardized. This technology is now taking off in the state of Goa both as pure crop and also as intercrop in cashew and coconut plantations. 	<ul style="list-style-type: none"> • Shri Kurade is cultivating turmeric in about 2-3 ha. With productivity level of 25-17 tonnes/ha. yearly and also supplying seed rhizomes of improved variety, besides which he has also started primary processing of rhizomes and making turmeric powder being marketed into the local market network • Taleshir Farmers' SHG produced 15 tonnes of seed rhizomes and further sold six tones to other SHGs in Cotigaon village under TSP programme.
5	<p>STFR Goa – Soil test based fertilizer recommendations Goa: An online web portal to prescribe fertilizer recommendations to major crops of Goa (Online use) Fertilizer calculator Goa: An android app to prescribe fertilizer recommendations to major crops of Goa (Offline use)</p>	<ul style="list-style-type: none"> • Information on the economic use of the costly agricultural input i.e. fertilizers and balanced fertilization to the crops. • Improved productivity of crops, higher net income to the farmer and maintenance of the soil fertility in a long run. 	<ul style="list-style-type: none"> • Reduced use of fertilizer by 20-31% and increased rice productivity by 18-32% caused an additional net income of Rs. 12730-22841 per hectare under rice cultivation of the coastal saline soils. • Reduced use of fertilizer by 23-27% and increased rice productivity by 20-26% caused an additional net income of Rs. 10250-16100 per hectare under rice cultivation of the under normal conditions.

6	Cross breed pig production technology	<ul style="list-style-type: none"> • Crossbred pigs known for better adoptability, faster growth, early maturity and better returns for the pig grower. • Accordingly, crossbred pig was produced by crossing Agonda Goan female with Large White Yorkshire male. • These crossbred pigs have better growth rate and feed conversion efficiency. They do not require intensive care like pure exotic breed like Large white Yorkshire. • This pig has better growth well adoptability for coastal climate. It can achieve up to 85kg body weight by 10 months age. 	<ul style="list-style-type: none"> • Local nondescript pigs grow about 100 to 125gms per day and Exotic pigs like Large White Yorkshire grows 450-500gms per day. • It was speculated to have crosses of local and exotic breed like Yorkshire which can grow up to 250 to 300 gms per day. • This can help to get more meat per unit time. • Crossbred pigs produced at institute showed excellent characters like average Birth weight 820.34±38.16gms, weaning weight at 40 days age 5.42 kg, weight at 10 months' age 85 to 90 kgs, average age of puberty 190 days, average age of sexual maturity 220 days, age of first farrowing 335 days and better pork with 3.36cms back fat thickness. • A very important characteristic of meat i.e. back fat thickness was significantly less in crossbreed than local and Yorkshire breeds. As the crossbred pigs attain around 60 kg body weight by 7 months of rearing, the farmer will get additional 30 kg body weight compared to local pigs. Therefore an additional income of Rs. 2000/- can be expected by growing one crossbred pig.
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7	Artificial Insemination in pigs	<ul style="list-style-type: none"> • Artificial Insemination in pigs boosted pig production in farmers' field with conception rate of 55% with higher number of births per elite boar. • Crossbred pig population was increased by 15% as farmers have adopted the technology with the production of 12,000 piglets gaining 40 kg extra body weight resulted in 480 tons of additional pork production, which generated of Rs. 9.6 crores covering Goa and adjoining coastal areas of Maharashtra and Karnataka 	<ul style="list-style-type: none"> • Boars of Large White Yorkshire were trained for donating semen. Sperm motility can be maintained for 3-5 days with short term extender and for 6-8 days with long term extender. • The total volume of the semen ejaculates for Large White Yorkshire boars was 223 ml. The progressive forward motility in Large White Yorkshire was 75.63. Acceptable motility of 30% was considered as the criterion for storing or discarding the semen sample.
8	Introduction of konkan kanyal goats for goat production	<ul style="list-style-type: none"> • Konkan Kanyal goat is a meat type breed adapted to high rainfall, hot and humid climatic conditions of Goa • The twinning percentage up to 90% • Birth weight of male kids ranged from 2.8-3.2 kg and female kids from 2.4 to 2.8 kg. • At 8-month age, the female goats weighed 32.36 kg and females weigh 36.43 kg. 	<ul style="list-style-type: none"> • The additional income will be through sale of goats (at the age of 8 months at which goats will gain body weight of 35-40 kg), manure and milk in a year. Twinning and triplicates will be common in goats, therefore if a small farmer is maintaining 10 animals (9 female and one male), he may get 20 kids during the gestation period of 5 months. • Market price of live weight in goats is Rs.400/kg BW. So at the age of 6 months, the body weight will be 35 kg (35kg x Rs 400 = 14000/animal). • Goat manure is also fetching high value due to its highest biomass and plant nutrients. Overall, additional income will be generated round the year by each household without much investment in the goat farming.

9	Hydroponic fodder production	<ul style="list-style-type: none"> • Hydroponics green fodder - Green fodders produced by growing seeds without soil. • Hydroponics green fodder is mostly produced in commercial unit. • Concept of Low cost Hydroponics Green Fodder Production Unit was attempted and popularized among farmers and inbuilt with a greenhouse (for growth of fodder) and a control unit, (for regulation of light, temperature, humidity and water) for optimum growth of fodder. • It was also tried in farmers field KVK North Goa. 	<ul style="list-style-type: none"> • Production one kg of maize fodder about 1.50 litres (if water is recycled) to 3.0 litres (if water is not recycled and drained out) of water is required. • Presently, in Goa, cost of production of the fresh hydroponics maize fodder is about Rs. 4-4.50/- per kg.
10	Bypass fat technology	<ul style="list-style-type: none"> • Bypass fat (Ca-LCFA) is prepared by treating vegetable (palm/ rice bran) fatty acid oil, the by-product of the oil refinery industry and technical grade calcium hydroxide/calcium oxide under specific conditions. • The indigenously prepared bypassfat contains about 70-75% fat and 7-8% calcium. The indigenously prepared bypass fat is kept in air tight container in cool place after mixing with butylated hydroxy toluene @ 0.05% as an antioxidant. • Supplementation of the indigenously prepared bypass fat @ 15-20 g/ kg milk production increases the milk yield up to 20% giving an additional profit of approximately Rs 10-30/ animal/ day. 	<ul style="list-style-type: none"> • Supplementation of bypass fat to dairy animals @ 15-20g/ kg milk production increases milk yield up to 20% and improves reproductive performances and health of animals • Cost of production of the bypass fat prepared indigenously is dependent up on the cost of the raw materials; however, it is significantly lower than the bypass fat products available in the market. • Daily feeding of approximately 300g bypass fat to dairy animals increases the milk production by 0.5-1.5 litre per day, giving net profit of about Rs. 10-25/- per animal per day. • This technology for production of bypass fat indigenously is very cost effective and affordable. • From 10 kg fatty acids and 4.0 kg calcium hydroxide/ calcium oxide, approx. 14 kg bypass fat is produced in short time, costing approximately half of the market price.

Technologies from ICAR-CPCRI, Kasaragod, Kerala for the state of Goa

S. No.	Technology Title	Brief Description (not more than 200 words)	Potential income increase due to adoption of technology (give in %)
1	Kalparasa (neera) tapping and its processing into value addition	Tapping of phloem sap from the coconut spadix with the use of 'coco-sap chiller' developed by ICAR-CPCRI not only collects the sap unfermented but also hygienic. It is a sweet, delicious and nutritive sap and as such can be sold as health drink. Further it can be processed into various value added products like coconut sugar, jaggery, syrup or concentrate which are in great demand both domestically and internationally.	Experience in various states of India as well as internationally it is 8 to 10 times more profitable to tap than selling the nuts.
2	Virgin coconut oil – Hot and fermentation process	VCO is obtained from fresh and mature coconut by mechanical or natural means, with or without use of heat, no chemical refining, bleaching or deodorizing and maintains the natural aroma and nutrients. Fully matured 11-12 months old coconut is selected for VCO production. The VCO production process involves dehusking, deshelling, testa removing, blanching, pulverizing, milk expelling, cooking / fermentation, filtering and packaging. ICAR-CPCRI has standardized the process technology and developed the machineries for the production of both hot and fermentation process VCO. It has also developed the technology for the value addition of by-products such as mature coconut water (converted into vinegar, jelly, RTE squash etc.), testa (bakery and confectionary products), coconut milk residue and VCO cake (used in bakery, confectionary and extrudate products). About 35 entrepreneurs had adopted CPCRI VCO technology till now.	It is estimated that at least 45% profit can be realized for the minimum processing of 500 coconuts per day. It is concluded that after producing 4200 kg of hot process virgin coconut oil, the no profit no loss point will occur which will correspond to a respective sales volume of Rs. 33.5 lakhs and this respective stage will arrive after 168 days of functioning of the unit. Therefore the VCO making unit will start earning profit from sixth month after installation.

3	Coconut chips	Coconut chips are crunchy, crispy and healthy snack food in place of present day junk food. It is rich in protein, fibre and anti oxidant compounds. 8-9 months old coconut is selected for chips production. The process involves dehusking, deshelling, testa removing, slicing, blanching, osmotic dehydration, drying and packaging. ICAR-CPCRI has standardized the process technology for the production of different varieties of coconut chips.	Coconut chips production venture provide at least 65% profit for a processing level of 250 coconuts per day. The break even period of 60 days is attained in this venture.
4	Tender coconut processing machineries (Tender coconut punch and cutter & Snowball tender nut machine)	ICAR-CPCRI has developed a simple tender nut punch and cutter to make hole in the tender nut and cut open the nut after drinking water. This will avoid the present day drudgery practice. ICAR-CPCRI has also developed snow ball tender nut machine to serve the tender nut in the form of ball with water intact after removing the shell.	These machines will raise the income of farmers cum entrepreneurs by at least 50%.

Technologies from ICAR-DCR, Puttur (Karnataka) for the state of Goa

Sl. No.	Technology Title	Brief description	Potential income increase due to adoption of technology (in %)
1.	Ultra high density planting	Planting of cashew under ultra density planting technique (3 m x 3 m or 2.5 m x 2.5 m) 400 to 600 plants per by super imposing regular productive pruning using selected cashew varieties such as VRI-3, Ulla-1, NRCC Sel-2 and hybrid H-130 has been successfully demonstrated in farmers field. About 3-4 tones of nut yield per ha can be harvested in the early stage of orchard life from ultra high density orchards. These technologies are package intensive and are more successful in hilly terrains of coastal and malnad tracts.	100 – 200 %

2.	Intercropping in cashew	In the high rainfall zones and also in the regions of availability of irrigation facilities, intercrops such as locally important marketable vegetables, pulses and medicinal plants can be grown as intercrops in widely spaced cashew plantations in the initial years of cashew crop. The suitability of season and type of intercrops is a most critical factor.	50 – 100% Depending on selected crop
3.	High yielding varieties/ hybrids	Till date, 43 high yielding cashew varieties have been released and recommended for cultivation. Of these, regionally suitable varieties can be grown successfully in different zones. A few hybrids viz., H-130, H-126, H-32/4 and NRC 493, NRC 301 with big apple and bold nut are under evaluation and in pipeline for release. Most of these are very high yielding (20-30%) and with premium kernel grade recovery (W 110 to W 180).	50 – 60 %
4.	Value added products	Protocols for the products from cashew apple such as cashew apple juice (RTS), jelly, jam, halwa and cider (low alcoholic beverage) have been standardized and market acceptability is being evaluated. This activity ensures effective utilization of cashew apple which is presently going waste, and will enhance the total income from cashew orchards.	20 – 40 %
5.	Homestead cashew processing units	Presently, the cashew farmers sell their produce to major processors at a lower price. In case they themselves adopt small scale processing the overall returns will be much higher. Further the retail rural economy will get a boost.	40-50 %
5.	Converting wastelands into cashew orchards.	The existing wastelands can be converted into cashew plantations through appropriate soil management practices. By this effective land utilization can be achieved and additional quantity of raw nut targeted can be obtained to meet the local processing needs of the nation.	50 – 60 %

Technologies from ICAR-IISR, Kozhikode for the state of Goa

S. No.	Technology Title	Brief Description (not more than 200 words)	Potential income increase due to adoption of technology (in %)
1.	Black pepper variety – IISR Shakthi	An open pollinated progeny of cultivar Perambramundi. Tolerant to quick wilt disease caused by Phytophthora. Mean yield (dry) (kg/ha): 2253 with a dry recovery 43.0%. Piperine 3.3%, oleoresin 10.2%, essential oil 3.7%.	Suitable intercrop in coconut and arecanut plantations with 30% increased income.
2.	Black pepper variety – IISR Thevam	A selection from the germplam. Mean yield (dry) (kg/ha): 2481, with dry recovery 32.5%. Field tolerant to Quick wilt disease caused by Phytophthora. Piperine 1.6%, oleoresin 8.15%, essential oil 3.1%.	Suitable intercrop in coconut and arecanut plantations with 30% increased income.
3.	Ginger variety – IISR Varada	A good quality and high yielding ginger variety with bold rhizomes. Average yield of 22.6 t/ha. Dry recovery of 20.7%. The variety has 3.9-4.5% crude fibre, 6.7% oleoresin and 1.8% oil. The variety is ideally suited for fresh ginger, dry ginger and ginger candy. Crop duration 200 days.	Suitable as intercrop in coconut and fruit tree plantations with 25% increased income.
4.	Turmeric variety – IISR Pragathi	High yield potential variety of turmeric, short duration (180 days), tolerant to root-knot nematodes, high yield (35 t/ha) and curcumin content of 5%	Suitable as intercrop in old coconut plantations with 15% increased income.
5.	Turmeric variety – IISR Prathiba	A high yielding turmeric variety is developed through open pollinated progeny selection. It is a high yielding (39.12 t/ha fresh rhizomes) with reddish yellow coloured rhizome and dry recovery of 18.5%. This variety has curcumin 6.2%, oleoresin 16.2% and essential oil 6.2%. Crop duration 225 days. A stable yielder across India for high dry yield and high curcumin content.	Suitable as intercrop in coconut and fruit tree plantations with 25% increased income.

6.	Nutmeg variety – IISR Keralashree	A high yielding nutmeg variety developed through farmer's participatory breeding programme. This variety has bold nuts with entire and thick reddish mace. Economic yield starts from 5 years and yields 7500 kg nuts and 1512 kg mace /ha at 10th year with 35% and 70% mace and nut recovery. It has a nut oil 5.9%, mace oil 7.5%, oleoresin in nut 9.1% & mace 7.5%, nut butter 24.9%, myristicin in nut 1.6%, mace 9.4%.	Suitable as intercrop in coconut and arecanut or fruit crop plantations with 30% increased income.
7.	Nutmeg variety – Konkan Sugandha	Bisexual variety of nutmeg which reduces the requirement of planting male and female trees for pollination. High yielding tree (526 fruits/ tree) adapted to Konkan region.	Suitable as intercrop in coconut, arecanut or fruit crop plantations with 10-15% increased income.
8.	Cinnamon variety - PPI (C)-1	High oil recovery from the bark (2.9%) and leaf oil recovery of 3.3%, bark oil 2.9%, leaf oil 3.3%, and bark recovery 34.22%. Suitable for an altitude range of 100-500 m MSL.	Needs less care and can be harvested in 2-3 years cycles with 25% increased income generation.
9.	Ginger and turmeric pro tray technology	Rapid multiplication of ginger & turmeric using single bud rhizome saves one third of the required seed material.	Saves 60% cost on ginger seed rhizome.
10	Plant growth promoting rhizobacteria (PGPR) for black pepper and ginger	There are eco-friendly PGPR formulations specific to black pepper and ginger available in biocapsule formulations. It reduces chemical fertilizer application rate by 25% and enhances tolerance to diseases. Recommended as soil drenching or mixing with organic base (FYM) and application to spices.	Suited for organic cultivation of spices and helps in increasing the yield by 10-15%.
11.	Trichoderma harzianum IISR-P26, a promising biocontrol agent for spice crops	The Trichoderma harzianum can be used successfully to manage Phytophthora in spice crops. The formulation is recommended for use in Integrated Pest Management as well as under Organic farming system, ensures socio economic and environmental sustainability and compatible with most of the chemical at prescribed dosage.	Significant reduction in disease incidence and increased productivity by 10-15%.
12.	Crop specific micronutrient mixtures for spices (Black pepper, Ginger, Turmeric)	Recommended @ 5g/L water and applied as foliar spray at 60 days after planting and 90 days after planting for ginger and turmeric; spraying twice in a year at April – May and August – September for black pepper. Increased use efficiency of applied nutrients based on the crop requirement	Yield increase of 15 to 25% and improvement in quality recorded and realized by farmers in black pepper, ginger and turmeric.

Success stories

Turmeric production Technology for Goa

Improved turmeric varieties were introduced, evaluated and standardized commercial production under Agro-climatic conditions of Goa which eventually resulted in recommendation of improved varieties like Prabha, Pratibha, Kedaram, Alleppey and Megha turmeric -1 for commercial production. Production technology is standardized. This technology is now taking off in the state of Goa both as pure crop and also as intercrop in cashew and coconut plantations.

Through FLD on Turmeric Production Technology with improved variety "Prabha", the technology was transferred to Farmers by name Shri shrihari Kurade, Cuncolim in Quepem Zone, South Goa; Taleshir Farmers' SHG, Gaondongrim, Cancona, South Goa.

Shri Kurade subsequently adopted the technology and continued till now. He is supplying the seed rhizomes also to other farmers also.

Shri Kurade is cultivating turmeric in about 2-3 ha. With productivity level of 25-17 tonnes/ha. yearly and also supplying seed rhizomes of improved variety, besides which he has also started primary processing of rhizomes and making turmeric powder being marketed into the local market network.

Taleshir Farmers' SHG produced 15 tonnes of seed rhizomes and further sold six tones to other SHGs in Cotigaon village under TSP programme.

Shri Kurade has been selling the seed rhizomes at the rate Rs. 50-60 /kg during the past 3-4 years and also encashing the opportunity of selling about 1.5—2.0 q of the pure turmeric powder @ of Rs.250/kg

Taleshir Farmers' SHG earned Rs. 3 lakhs by selling about 6 tonnes of seed rhizomes to other tribal farmers, @ Rs.50/kg.

The technology is transferred to Directorate of Agriculture, Government of Goa for further promoting the same in Goa state.

Under TSP programme, The technology was also transferred to Taleshir Farmers' SHG, Gaondongri, Cancona Zone.



Artificial Insemination

Mr. Felipe Agnelo Gracias, H. No.- 745, Malwara, Aggasaim- Goa (Mob- 9527537470) , a NRI came from UK. He came to ICAR –CCARI, wanting to start piggery business but without any idea about it. After attending trainings on Scientific rearing of Pigs conducted by ICAR-CCARI Goa and visiting fellow farmers with complete guidance of ICAR-CCARI he set up pig unit with holding capacity of 250-275 pigs. He started out with 10 pigs. Initially he faced lot of problems with respect to breed of pigs, growth rate and health issues and as such incurred losses on the business. Then after attending the training on Artificial Insemination in Pigs at the institute, he changed is breeding strategy and started using AI is herd. And thus, increased his herd strength up to 250 pigs.

So far he has bred 160 females artificially with conception rate of more than 80% and litter size of 8 piglets. There is significant upgradation of his Pig herd visibly in terms of Birth weight, litter size and growth rate. Earlier he got litter size of 5-6 piglets with birth weight around 700 gms and with AI he is getting litter size of 8 piglets with birth weight of 900-1000 gms which has directly translated into higher profits. Mr. Felipe sells around 10 pigs monthly of around 90-100 kgs @ Rs. 10000/- thus getting income of Rs. 100000/- on sell and spends Rs.20000/- on Labour Cost and Rs. 20000/- on feed and medicines thus garnering profit of Rs 60000 /- per month. Because of AI there is higher growth rate therefore earlier his pigs used to growth upto 60-70 kgs in 10 months with same input as compared to growth of upto 100 kgs in 10 months for pigs born through artificial insemination, so he makes profit of Rs @2000- 3000/- more on each pig born through artificial insemination He maintains farm hygienically and scientifically, adopts new technologies therefore he was given elite breeding stock 6 nos crossbred female and 1 crossbred male from institute pig farm, vaccines and all the requirements of A.I. (Catheter, semen) under DBT project Augmentation of rural pig production for socio-economic upliftment of the rural poor in Goa through artificial insemination. Besides this Mr. Felipe was training on Artificial Insemination.

Technology intervention through AI to farmers doorstep at free of cost on demand along with timely inputs and veterinary assistance has made the farmers to except the proposed technology whole heartedly and as a spin-off effect, the income /expenses ration is increasing favourably.as a result other famers also ready to adopt AI technology. The increased capacity technology and expertise acquired by the institute has enabled the staff to train AI technicians. This successful project exemplifies the efforts of the ICAR- CCARI, Goa in assisting the farmers to improve livestock productivity and food security and thus alleviating the poverty.



7

Value Chain Development, Market Linkages and Trade Potential

1. Interlinking of stakeholders like producers to consumers through of networking.
2. Interlinking of different marketing operators for marketing of farm produce:
3. Establishment of cold storage units and /or warehouses/godowns and their effective linkage with intermediary agencies involved in pooling of farm produce.
4. Interlinking of agriculture processing units for supply of raw materials either for primary or secondary processing/value addition
5. Trade potential: market intelligence driven trading for all types of commodities with an objective of meeting demand and supply besides assured and stable market trends
6. Policies and Regulatory authorities for overseeing effective modus operandi of operating of all the above sectors

Examples of agriculture value addition and processing units

Crops/commodities	Strategies
Paddy	Establishment of community agro- processing centres Establishment and promotion of storage structures
Coconut	Establishment of processing units for virgin coconut oil and other products (in numbers)
Cashew	Cashew apple value addition including feni Cashewnut value addition
Other fruits/crops	Establishment of community multi product processing plants for value addition of Kokum, Jackfruit, Breadfruit, Jagoma, Wax Apple, Jamun Karonda, star fruits, etc. (in numbers)
Dairy and meat products	Establishment of units for value addition in Dairy milk products and pork and mutton products (in numbers)

Present status of market linkages

Rice: Half of the paddy produced is presently marketed to the rice mills and partly the paddy is also processed at home scale for converting into parboiled rice, poha (pressed/flaked), and then supplied to local markets/sold at the farm level.

Horticulture produce like cashews, coconut, arecanut and banana are sold to collection centres of cooperative societies (Goa Bagayatdar society, Adarsh cooperative society etc), besides selling of some produce to the local level middlemen.

For perishable horticulture produce like vegetables and fresh fruits are marketed through assured markets like Goa State Horticultural Corporation Ltd. (GSHCL) procurement centres and also sold directly.

APMC provides marketing support through a main yard and two sub-yards. Govt.'s proposal to set up taluka level procurement centres is yet to be implemented. Marketing linkages, preferably at village level are required to be created for linking the producer directly to the retail sale points. There are 5 market sub yards at Ponda, Sanquelim, Mapusa, Valpoi and Pernem equipped with modern and scientific infrastructural facilities. There is a plan to establish market at Banastarim apart from taluk level procurement centres.

The State Marketing Board has established 5 market yards. There are six local rural mandis in the north district in Bicholim, Valpoi, Sattari, Mapusa, Marcel and Calangute. A new vegetable market in area admeasuring 1,500 sq. mt has been opened in Mapusa. Village haats could be developed in strategic places to enable direct marketing by farmers.

To boost vegetable cultivation in Goa, schemes are providing assured markets through the 18 procurement centres of Goa State Horticultural Corporation Ltd. (GSHCL).

The Govt.'s efforts to boost dairy and poultry projects would require feed godowns. Besides, many of the godowns of the APMC need to be renovated/rebuilt as per norms. Marketing federations are also in need of expanding their storage capacity. Transportation of produce to the nearest market increases the cost at farmers end thereby reducing returns. Private initiatives in setting up of market yards could be promoted in Sanguem and Darbandora, which are not covered by APMC. This coupled with setting up of cold storages for perishable goods would help in cutting transportation costs and realising better returns.

Rural Godowns: APMC godowns are not in good shape and need to be renovated. Private godowns are owned by rice millers, cashew industries or oil millers for storing their raw materials. It is due to the lack of storage space at village level which forces the farmer to sell areca, cashew, copra and pepper, etc., without waiting for remunerative market prices. The Storage capacity of farmers federation like Bagayatdar is also inadequate to meet demand. While State Govt.'s proposal for construction of village level godowns is yet to take off, financially strong PACS, farmers groups or FPOs could consider investing in storage facilities for long term benefits. This would encourage introduction of Negotiable Warehousing Receipts (NWR) for availing pledge finance by farmers.

8

Policy and Investment Requirements and Role of the Government

- Contract and/or community farming to be initiated through appropriate government policies
- Government of Goa need to take certain reforms in rule related to Landowning and subsidies as well as support price for agricultural produce.
- To bring more land under irrigation, 'Pradhan Mantri Krishi Sinchai Yojana' is proposed to be implemented in mission mode
- To provide a common e-market platform for wholesale markets, Unified Agricultural Marketing ePlatform to be implemented.
- Govt. has proposed 50% subsidy for the use of organic inputs by farmers.
- Polyhouse vegetable and flower production to be supported with assured marketing arrangement through Goa State Horticulture Development Corporation Ltd.
- Govt. has decided to promote Community Dairy farming, with a total initial estimate of Rs. 1.50 crore.

9

Implementation Plan and Institutional Responsibilities

ICAR-CCARI Goa will be responsible for providing recommendation of suitable HYV for Goa state and for providing technical training to farmers, stakeholders and other policy makers for doubling of farmer's income

Implementation plans

1. Productivity improvement in crops

Crops	Plan/Strategies	Institutional Responsibilities
Paddy	Introduction of High Yielding Varieties (HYV):	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for distribution of HYV seeds)
	Increasing the Seed Replacement Ratio (SRR) of existing popular varieties	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for distribution of seeds) KVK (North Goa) and KVK (South Goa) (for distribution of seeds)
	System of Rice Intensification (SRI)	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for Demonstration) KVK (North Goa) and KVK (South Goa) (For popularization of SRI technology)
	Certified seed production of HYV as an enterprise	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for certification, procurement and distribution) KVK (North Goa) and KVK (South Goa) (For identifying entrepreneurs for seed production)

Crops	Strategies	Agency responsible for Implementation
Cashew	Replacement of senile plantation with HYV	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for distribution of HYV grafts/plants)
	Nutrient management (INM and IPM) in cashew	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for popularization of INM practices and supply of necessary inputs) KVK (North Goa) and KVK (South Goa) (for demonstration and dissemination of INM practices)
	High density planting of HYV	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for distribution of HYV grafts/plants)
Mango	Creation of new orchards of improved local varieties by high density planting	<ul style="list-style-type: none"> Directorate of Agriculture, Goa (for distribution of HYV grafts/plants) KVK (North Goa) and KVK (South Goa) (for distribution and demonstration of HYV)

Coconut	Introduction of Dwarf – HYV in coconut	<ul style="list-style-type: none"> • Directorate of Agriculture, Goa (for distribution of HYV grafts)
	Inter cropping management – Forage / Spices / Fruits / Floriculture	<ul style="list-style-type: none"> • Directorate of Agriculture, Goa (for popularization and supply of necessary inputs) • KVK (North Goa) and KVK (South Goa) (for dissemination and demonstration of technologies)

2. Crop Diversification, Intensification and Integrated Farming System (IFS) approaches (Integration of potential crops, animal and fishery) and advanced management practices like nutrient management and plant protection measures

Crops	Strategies	Agency responsible for Implementation
Utilization of rice fallow lands for pulses like cowpea, green gram (Mung) & Ground nut	Area expansion under paddy fallow lands	<ul style="list-style-type: none"> • Directorate of Agriculture, Goa (for distribution of HYV pulses)
Vegetables	Introduction of varieties along with production and protection technologies	<ul style="list-style-type: none"> • Directorate of Agriculture, Goa (for distribution of HYV seeds)
High value Horticultural crops and spices	Introduction of varieties along with production and protection technologies	<ul style="list-style-type: none"> • Directorate of Agriculture, Goa (for distribution of seeds, planting materials)
Creating models of IFS in farmer field with different components	IFS models in South and North Goa with best components	<ul style="list-style-type: none"> • Directorate of Agriculture, Goa (for popularization of IFS, supply of critical components and schemes)

3. Production improvement in animal and fishery sector

Crops	Strategies	Agency responsible for Implementation
Green fodder production	Area expansion of green fodder cultivation through extension activities and schemes	<ul style="list-style-type: none"> • Directorate AHVS
Advance technology like Hydroponic fodder for landless farmers	Demonstration and establishing models in field	<ul style="list-style-type: none"> • Directorate AHVS (for formulation of schemes)

Dairy cattle	Strategies	Agency responsible for Implementation
	Introduction of exotic germplasm through AI not exceeding 50% genetic makeup	<ul style="list-style-type: none"> • Directorate of AHVS (for AI programmes)
	Introduction of indigenous breeds: Gir, Sahiwal and Red Sindhi	<ul style="list-style-type: none"> • Directorate of AHVS (for supply of indigenous breeds and maintenance of germplasm)
	Community dairy farming	<ul style="list-style-type: none"> • Directorate of AHVS (for proposal of schemes and incentives)
	Cattle markets	<ul style="list-style-type: none"> • Directorate of AHVS (organisation of cattle markets)

Improvement in Meat and egg production	Strategies	Agency responsible for Implementation
Goat	Introduction of coastal goat breeds (Konkan Kanyal) under stall feeding	<ul style="list-style-type: none"> • Directorate of AHVS (for supply and multiplication of goat breeds, formulation of schemes)
Pig	Introduction and conservation of indigenous and cross breed pigs	<ul style="list-style-type: none"> • Directorate of AHVS (for conservation and multiplication and supply, formulation of schemes)
Poultry	Improvement in backyard poultry and coloured broilers for meat and egg production	<ul style="list-style-type: none"> • Directorate of AHVS (for multiplication and supply of chicks, formulation of schemes)

4. Mechanization in agriculture and allied activities

Mechanization in agriculture and allied activities	Strategies	Agency responsible for Implementation
	Mechanisation of Land preparation, planting and harvesting	<ul style="list-style-type: none"> • Directorate of Agriculture –subsidies and creation of machinery bank
	Mechanization in coconut harvesting	<ul style="list-style-type: none"> • Directorate of Agriculture –subsidies and creation of machinery bank

5. Creating value chain-supply network by Post-Harvest management and Value addition

Value addition in agriculture and allied activities	Strategies	Agency responsible for Implementation
Paddy	Establishment of community agro- processing centres Establishment and promotion of storage structures	Directorate of Agriculture –subsidies and creation of machinery bank
Coconut	Establishment of processing units for virgin coconut oil and other products	Directorate of Agriculture – subsidies, Coconut board
Cashew	Cashew apple value addition including feni Cashewnut value addition	Directorate of Agriculture –subsidies and creation of machinery bank
Other fruits/crops	Establishment of community multi product processing plants for value addition of Kokum, Jackfruit, Breadfruit, Jagoma, Wax Apple, Jamun Karonda, star fruits, etc.	MOFPI & Directorate of Agriculture –incentives and funding
Dairy and meat products	Establishment of units for value addition in Dairy milk products and pork and mutton products	MOFPI & Directorate of Agriculture –incentives and funding

6. Fisheries sector

State Fisheries department is responsible for:

- Better availability of the fish seeds, promotion of mussel farming, capacity building and awareness creation, etc.
- Improved storage facilities – cold ice plants, insulate vehicles, etc can also play an important role for marketing of the fish catch.
- Development of integrated farming systems with fishery as an important enterprise can ensure regular income and improved production.
- Post-harvest handling, value addition, allied activities like ornamental fish farming also have potential to contribute to improvement in income.

The State-wise Coordination Committee (SCC) constituted to design road map for doubling Farmer's income by March, 2022 for the state of Goa by Secretary (DARE) & DG, ICAR New Delhi vide order F.No.5-4/2017-Cdn (Tech) dated 6th March, 2017. The main objective of the committee is to develop the concrete action plan for doubling the farmers' income for Goa keeping in view of existing productivity and income levels of farmers in Goa state, to develop strategy needed to double the income of farmers/agricultural labourers by March 2022. The first SCC meeting was convened on 27th, March, 2017 under the chairmanship of Director, ICAR-CCARI, Goa and other members. The detailed deliberations, baseline information and area specific technologies suitable to double the income of farmers were discussed.

The proposed action plan for Goa state include mainly the productivity improvement in major crops like paddy, cashew and coconut, diversification in agriculture, creation of IFS models, mechanisation, value addition and policy reforms in agriculture including marketing strategies

The potential pilot models in agriculture and allied sectors in each districts of Goa need to be established in the farmers' field. The performance and progressive income from the models need to be documented to showcase the doubling of income in the state by respective implementing agencies.

Further, the committee recommends constituting of District Level Monitoring and Evaluation Committees under the Chairmanship of District Collectors who are Chairmen of ATMA. Programme Coordinators, KVK will be the Convenors for the above committees with the representatives from all line departments as Members for both South and North Goa for effective monitoring of action plan.



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