

# Vision 2030



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GOVERNMENT OF GUJARAT

## MESSAGE

Vision means a dream of expected aspiration. NAU's vision document-2030 describes what an organization would like to achieve or accomplish in future. I have gone through the Vision document of NAU which reflects challenges in terms of diverse agro-climatic conditions, competition for land and water by industries and growing population, increased demand for quality food etc. At the same time it also provides an opportunity to peep into strategies of University to achieve its target by the year 2030. Therefore, I feel that this document may give strong support and guidelines for preparing strategic plans to boost the agricultural development in coming years.

I am happy to note that the 'NAU's Vision 2030' document has been prepared on the line of already published Vision-2030 by various ICAR institutes of the country. It is expected that challenges and opportunities depicted in 'NAU Vision-2030' document will be helpful to the agricultural scientists, policy makers and stakeholders for addressing challenges in future. This document may act as guiding force for making agriculture sustainable and profitable in future.

Gandhinagar  
2<sup>nd</sup> February, 2012

  
( Dileep Sanghani )



**DR. S. AYYAPPAN**  
SECRETARY & DIRECTOR GENERAL

भारत सरकार  
कृषि अनुसंधान और शिक्षा विभाग एवं  
भारतीय कृषि अनुसंधान परिषद्  
भारतीय कृषि मंत्रालय, कृषि भवन, नई दिल्ली ११०११४  
GOVERNMENT OF INDIA  
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION  
AND  
INDIAN COUNCIL OF AGRICULTURAL RESEARCH  
MINISTRY OF AGRICULTURE, KRISHI BHAVAN, NEW DELHI 110 114

## FOREWARD

The diverse challenges and constraints as growing population, increasing food, feed and fodder needs, natural resources degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR and SAUs to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, Navsari Agricultural University, Navsari has revised and prepared Vision-2030 document highlighting the issues and strategies envisaging agricultural scenario for the next twenty years.

South Gujarat with its long coast line, hilly undulated tract, salt affected soils, irrigated fertile plains, low to high rainfall areas and highly industrious, educated to illiterate tribal population faces formidable challenge. These challenges will be much grave in next two decades due to declining water availability, shrinking land resources, fast changing environment and market demand. At the same time, generating highly trained and skilled human resources, developing technology for efficient and profitable crop production competitive at internationally cost and quality and transferring the same to the stakeholders will be great task to accomplish.

I am glad that Navsari Agricultural University (NAU), Navsari, Gujarat, which has its strength in crop research like cotton, sugarcane, rice, sorghum, hill millets and areas like water management, by and waste product utilization, organic farming, post harvest technology has come out with a Vision-2030 document.

It is expected that the analytical approach and forward looking concepts presented in the 'Vision-2030' document will prove useful for the researchers, policymakers, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.

Dated the 30<sup>th</sup> January, 2012  
New Delhi

( S. Ayyappan )



Navsari Agricultural University



A. R. PATHAK

Vice Chancellor  
Navsari Agricultural University  
Navsari (Gujarat)

## PREFACE

As visualized by Mahatma Gandhi decades ago, agriculture continues to be the backbone of the Indian economy. South Gujarat has diverse agro-climatic conditions viz. heavy and medium rainfall area, fertile and saline land, undulated hilly tract, urbanized and industrialized area, forest land, irrigated and rainfed cultivated land. Major crops of South Gujarat are cotton, rice, sugarcane, sorghum, hill millets and pulses. South Gujarat is also known as fruit basket of Gujarat as mango, banana, sapota and papaya, various vegetables and flowers like gerbera, anthurium, roses, gladiolus etc. grown here are marketed in India and abroad.

NAU has very good educational set-up for imparting education to undergraduate and postgraduates in the faculties of agriculture, horticulture and forestry, veterinary sciences and agribusiness management. University also started five polytechnics to provide medium skilled technicians to work at grass root level. Besides, NAU has a strong research set-up in terms of 15 research stations and an organized extension set-up comprising of four Krishi Vigyan Kendras, ATIC and various training centres. The University has remarkable achievements in crops like cotton, sugarcane, rice, sorghum, hill millets, mango and turmeric, soil and water management, bio-fertilizers, bio-pesticides, waste management, post harvest technology and organic farming. The University also developed technology to prepare useful products like quality paper, cloth and edible candy from banana pseudostem a waste of banana.

The vision document of NAU focuses perspective plans and strategies to transform vision into reality for coming two decade. I express my gratitude to her Excellency, Dr. Shimati Kamla, Governor, Gujarat state, who is guiding force behind the preparation of Vision -2030 document. I am grateful to Shree Dileep Sanghani, honourable Minister of Agricultural and Co-operation, Government of Gujarat for valuable guidance and constructive suggestions. I sincerely, thank Dr. S. Ayyappan, Secretary DARE and Director General (ICAR) for inspiring all ICAR institutes and SAUs for preparing vision and positive suggestions on research programme.

I am thankful to scientists of NAU for providing necessary inputs in preparing the documents. I also thank Dr. A.N. Sabalpara, Director of Research and his team for compilation of document.

Navsari  
February, 2012

  
( A.R. PATHAK )

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# Vision 2030

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## **Preamble**

Gujarat state is located on the western coast of India, neighboring Arabian Sea on the West and sharing international border with Pakistan on North West and surrounded by Rajasthan, Madhya Pradesh and Maharashtra. Gujarat occupies the geographical area of 1,96,022 km<sup>2</sup> nearly 6% of country with a forest covers of around 10 per cent and nearly 86 million ha area under cultivation. The state has a longest coastal line of 1600 km.

Navsari Agricultural University (NAU) is located in South Gujarat with Navsari as head quarter. NAU was established on May 1, 2004 by carving out of GAU for carrying out location specific need based research for enhancement of agricultural productivity and contribute to rural development through popularization of improved varieties, technology and scientific knowledge amongst the farmers of South Gujarat.

NAU has well developed educational set-up to impart education at under graduate and post-graduate level in the fields of Agriculture, Horticulture, Forestry and Veterinary sciences. Additionally, it has a post graduate Institute of Agri- business Management. The NAU also offers diploma courses in agriculture and allied sciences through five polytechnic colleges located at various places in South Gujarat.

Demographically, jurisdictional area of NAU is divided into tribal and non-tribal areas. Out of seven districts, four districts are tribal dominated, whereas, rest three districts are well urbanized and industrialized.

Geographical area under the jurisdiction of NAU is 26,63,107 ha with cultivated area of 13,85,269 ha of which, 5,77,897 ha irrigated (42 per cent) and remaining 58 per cent is rainfed. The University jurisdiction also has around 300 km of coast line.

NAU has very well knit research set-up in terms of two zonal research stations, two main research stations, two regional research stations and nine verification and testing centers to accomplish area specific need based agricultural research.

Based on demands and agro-climatic conditions, NAU focuses its research on mandate crops such as cotton, sugarcane, paddy, sorghum, millet, pulses, niger, mango, sapota, banana, cashewnut, oil palm and tuber crops besides research on soil and water management, biotechnology, post harvest technology, high tech horticulture, acarology and improvement and conservation of Surti buffaloes and goats.

'NAU vision 2030' document presents key challenges of South Gujarat like ingress of salinity in coastal belt, soil erosion caused by high intensity rainfall in undulated topography and predominance of water guzzling crops coupled with unscientific water management leading to water logging and secondary salinity in canal command, degradation of soil health due to injudicious use of chemical fertilizers, delayed onset of monsoon, shrinking of land resources inadequate availability of cold chain and storage facilities for fruits, vegetables, flowers and dairy produce are some other issues which need to be addressed to meet the requirement by 2030. At the same time, NAU vision 2030 also depicts opportunities for doubling the productivity of mandate crops through genetic improvement, development of water logging resistant and salinity/ drought resistant crops to bring more and more area under cultivation, development of water-use efficient,

temperature tolerant and nutrient use efficient crops. Development of root-stocks of mango and sapota for specific purposes like establishing high density orchards, tolerance to salinity and soil borne diseases, readiness to deal with ingress of many exotic pests and diseases are some other priorities that will be attempted with greater emphasis. Because of increasing demand of organic food on global scale, maintaining soil health by using low cost bio-pesticides and bio-fertilizers and by promoting conversion of farm waste into bio-compost, vermi compost value added products and development of neutraceutically rich varieties and hybrids of fruits and vegetables will be other priorities. Long coastal line under the jurisdiction of NAU demands to establish College of Fisheries and Aquaculture for promoting fisheries in scientific manner so as to enhance profitability of large population of fishermen in South Gujarat. At the same time, inland fisheries can be promoted in water logged areas as an alternate to agriculture. Tribal dominated area can be exploited for development of poultry industry to enhance income of tribal, provide employment, prevent migration and to meet the demand of protein rich diet in nearby urbanized area.

Alternatively, in tribal area utilization of high valued crop like cashew, pepper etc. can be promoted. Presently, India imports about 0.60-0.70 million tons of cashew annually to meet local demands by spending precious money. Therefore, cashew farming in tribal area of South Gujarat will not only help to alleviate poverty of tribal but also support Indian cashew industry.

Simultaneously, olericulture and floriculture may also be considered as third option for tribal area of South Gujarat, to meet increasing demand day by day in cosmopolitan and metro cities. However, before initiating olericulture and floriculture, cold chain and storage facilities need to be developed in advance to minimize post harvest losses of perishable farm produce. Similarly to improve livelihood of tribal, collection, processing and marketing of forest produce need to be focused.

Gujarat has the distinction of being the first state to enact the Special Economic Zone (SEZ) Act, 2004. Special Economic Zones are growth engines that can boost manufacturing, augment exports and generate employment. The Government has introduced the scheme of SEZs in order to provide a hassle free operational regime and encompassing state of the art infrastructure and support services. Special Economic Zone is a specifically delineated duty free enclave and shall be deemed to be foreign territory for the purpose of trade and operations and duty and tariffs. SEZ units may be set up for manufacture of goods and for rendering of services – public, private or joint sector or by the State Government.

South Gujarat is known as bowl of horticulture and therefore, Government of Gujarat declared it as "Agri-export Zone". The main horticultural crops of South Gujarat are fruits, vegetables and flowers. Alphonso and Kesar are main varieties of mango grown in South Gujarat. The NAU has released new varieties of Mango like Neelphanso, Neeleshwari, Neelshan and Sonpari. Out of these, Sonpari is largely adopted for cultivation by farmers of Gujarat. In South Gujarat, Sapota cultivation is practiced since last 100 years and largely cultivated variety is Kalipatti with highest productivity (10 tons/ha).

## Agricultural Scenario

The state of Gujarat is situated on the West coast of India and lies between 20° 1' and 24° 7' N latitude and 68° 4' and 74° 4' E longitude. It is flanked by the Arabian sea on the West, the Gulf of Kutch and Rajasthan in North and Madhya Pradesh in North – East and Maharashtra in the South and South-East. The state has geographical area of 196117 km<sup>2</sup> representing 6 per cent area of the country and accommodating 604 lakh population with density of 308 persons/km<sup>2</sup> (Census, 2011). Administratively, Gujarat is divided into 26 districts which are further sub divided into 227 talukas (tahsil) which comprise of 18,618 villages and 242 towns.

Agroclimatically, the state is classified into eight agro-climatic zones which are further delineated into 62 agro ecological situations (AES). This classification almost matches with the zones delineated by NBSS&LUP, Nagpur (Maharashtra). As per this classification, the state is grouped into seven agro ecological sub-regions (AESR).

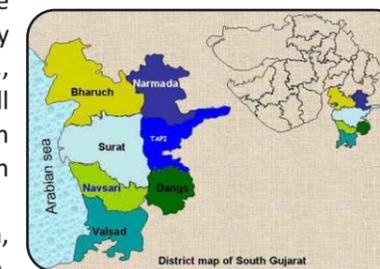
Physiographically, Gujarat is divided into three distinct units viz., undulating and hilly terrain on East, mid plain and coastal belt in West. The state has unique distinction of possessing longest sea coast of 1600 km. The rainfall received in the state varies from less than 300 mm in North-West (Kutchh) to more than 2000 mm in South-East (The Dangs and Valsad). With respect to soil types, in North and North-West Gujarat soils are extremely sandy (>95 % coarse sand) and those in South Gujarat soils are predominantly clay in texture with more than 40 per cent clay content. While the soils of middle Gujarat are loamy in texture, those in Saurashtra region the soils are medium black, calcareous in nature. At present, about 52 and 7 per cent of the total reported area as are under cultivation and forest, respectively. Because of agroclimatic diversity, array of crops are grown in Gujarat. So the crop production related constraints also vary with agro ecological situation present in the state.

The land use pattern of Gujarat indicates that of the total reported area (196 lakh ha), net sown area, barren and uncultivable land; cultivable waste, forest and non agricultural use constitute 52.1, 13.8, 9.8 and 6.2 percent respectively.

Gujarat has good irrigation facilities like canals over 21.5 lakh ha and Sardar Sarovar Narmada Nigam Limited to around 17 lakh ha land. Additionally, there are 1,13,728 check dams and 55,917 Boribands and 2, 40,199 farm ponds providing irrigation for agriculture.

Navsari Agricultural University (NAU) has the jurisdiction in seven districts of South Gujarat viz. Narmada, Bharuch, Surat, Tapi, Navsari, Dangs and Valsad. Geographically, it is situated between longitude 72°54' East and latitude 20°57' North. The operational area can be broadly categorized into 2 major agro-climatic zones viz., South Gujarat heavy rainfall zone with annual rainfall of 1592 - 2534 mm in 65-95 rain days and South Gujarat zone with annual rainfall of 798 - 1655 mm in 31-71 rainy days (Agro - climatic zone-XIII, 3.1,3.2).

Major crops of Gujarat State are cotton, ground nut, wheat, bajra, maize, mustard, sesame,



pigeon pea, green gram, paddy and sugarcane. Gujarat is the largest producer of cotton, castor, tobacco and isabgul (psyllium) and second largest producer of sesame, ground nut in the country. As far as productivity of an individual crop is concerned, Gujarat has attained highest productivity in mustard, castor and cotton, second highest productivity in ground nut and bajra and third highest productivity in gram and clusterbean. Out of these, mandate crops for research in NAU are cotton, sugarcane, rice, sorghum, hill millets and pulses.

Major horticultural crops of Gujarat are mango, banana, sapota, lemon, guava, tomato, potato, okra, onion, cumin, garlic, isabgul and fennel grown over 13.54 lakh ha of land with 173.00 lakh tons production of horticultural crops in 2010-11. Gujarat has highest productivity in onion, potato, cumin and fennel and second highest productivity in banana and tomato. However, it has third highest productivity in pomegranate, guava, lime, papaya and isabgul in the country. The mandate horticultural crops of South Gujarat are mango, banana, sapota, papaya and vegetables. Lately floriculture has made inroads in South Gujarat in a big way. Gerbera, Chinese rose, Gladiolus, Anthurium and Sword Lilly are being grown in protected condition boosting the economy of the area and adding new dimensions to agriculture.



Gujarat has 235.15 lakh livestock and poultry in the state comprised of mainly 79.76 lakh cattle and 87.74 lakh buffaloes. Gujarat is the home of important breeds of cattle (Gir and Kankrej), buffaloes (Mehsani, Jafrabadi, Surti and Banni), horses (Kathiawadi and Marwadi), camel (Kutchchi), sheep (Patanwadi and Marwadi) and goats (Surti, Mehnsani, Kutchchi and Zalawadi). Animal Husbandry has been making significant contribution to state's Agriculture GDP amounting to 23.5 per cent of share of Gujarat state and has very well developed dairy sector i.e. 12 district milk producers union, 15 Co-operative dairy plants, 25 private dairy plants and 13,761 milk co-operative societies with 20.84 lakh members of milk Co-operative societies. The State produces around 150 lakhs liters of milk per day.



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**Agriculture and economy**

Agriculture contribution in the gross domestic product of India is fast declining, which in 2008-09 touched at 15.7 percent from about 30 percent in 1990-91. During the last two decades, the annual growth of agricultural sector was less than half (around 3 percent) of the overall average growth of economy (6.7 percent). On the contrary, the agriculture contribution in Gujarat states GDP was around 10 percent over last one decade and more importantly the contribution of animal husbandry to state's GDP was 5 percent. Despite significant growth in industrial sector, agriculture sector provides employment to 52 percent of present work force of the country, which used to be 61 percent in 1990-91. Similarly in Gujarat, especially in South Gujarat, the growth of industrial sector out paced growth of agricultural sector. This resulted competition for man power and agricultural operations are becoming more difficult. Probably, it is right time to redesign agricultural policies with prime focus on mechanized farming.

**Smallholder's agriculture**

Major factors like significant growth in industrial sector, encroachment of concrete jungle into agricultural fertile land and increasing population jointly resulted reduction in land holding size. The average size of land holding of India declined to 1.32 ha in 2000-01 from 2.30 ha in 1970-71, with concurrent increase in operational holding from 70 to 121 millions. The size of land holding is expected to reduce further to 0.68 ha in 2020 and 0.32 ha in 2030. Similarly, the Net Sown Area (NSA) in Gujarat and South Gujarat is 0.19 ha and 0.16 ha, respectively. Therefore, the situation is gloomy for Gujarat and more so in South Gujarat. Significant decrease in size of land holdings, non significant increase in productivity of various crops in Gujarat state and lack of other sources of income compelled rural population to switch over to animal husbandry and/or horticultural crops. Therefore, it is imperative to improve seed quality and post harvest production technologies and management to maintain continuous increase in the income of farmers. NAU looks forward to explore the possibilities to raise the income of rural population of South Gujarat by promoting horticulture, animal husbandry and fisheries in future.

**Deteriorating production environment**

The problem of land and water degradation in addition to small size landholding, poses a serious threat to agricultural sector. Presently, it is estimated that 120.72 million ha land is degraded due to soil erosion and about 8.4 million ha land has problem of salinity



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and water logging.

Gujarat has 1600 km long coastal line of which 300 Km falls under NAU's domain, posing a serious threat of ingress of sea water. Secondly, South Gujarat has large undulated hilly area which is prone for soil erosion cause by rain water. The situation is further worsened, when nutrient loss is taken into consideration. Annually, India is loosing about 0.8 million tons of nitrogen, 1.8 million tons of phosphorus and 26.3 million tons of potassium due to erosion and Gujarat and particularly South Gujarat is no different because of heavy rainfall.

Imbalanced use of macro and micro nutrients further deteriorates the fertility of soil. The picture of imbalance application of nutrients is far better in Gujarat as compared to many states of the country. The nutrient application ratio (N:P:K) in Gujarat and South Gujarat is 7.2: 2.8 :1 and 2.53:1.03:1, respectively.

In this direction, NAU has already initiated important steps to promote use of bio-compost, bio-fertilizers and bio-pesticides to combat soil degradation and improve soil health. Simultaneously, NAU started taking these technologies to farmers of South Gujarat through extension efforts of the University and line departments of Government of Gujarat.

#### Scarce water resources

The Indian agriculture is supporting 16.8 percent world's population from 2.42 percent world's land and 4 percent of world's water. Therefore, to achieve targeted food productivity it is necessary to increase current irrigated land at 66 M ha to 80 M ha by 2030. Secondly the crop productivity has to be increased from 2.3 tons/ ha to 4 tons/ ha under irrigated condition and 1 ton/ha to 1.5 ton/ha in rain fed area.

Provision of water for agricultural purpose is the most important concern of Gujarat state, as per capita availability of fresh water is 60 per cent of the national average. Secondly, 78 per cent of drinking water supply is dependent on ground water. Water table is going down at an alarming rate in North Gujarat and rising in South Gujarat, 27 per cent villages have water with excess of fluoride and nitrate and reduction of quality of water by 26 per cent over last 15 years are the major concern of the state.

With respect to natural resources in South Gujarat, out of 22.68 lakh ha, 11.48 lakh ha i.e. 50.6 per cent area is net sown area. On an average 45 per cent area is irrigated by surface water and rest of 55 per cent by ground water. Efficient use of water resources through MIS and other technologies is envisaged in next two decades.

#### Growing Food Demand

The food grain demand according to further projections of country would increase from 192 million tons in 2000 to 345 million tons by 2030. Thus to meet 55 percent more food grains by 2030, production of food grains needs to be increased at the rate of 5.5 million tons annually. Moreover, rising per capita income would demand rich food commodities (fruits, vegetables, milk, meat and fish) by more than 100 percent during this period.

The total geographical area (TGA) of South Gujarat is 23.81 lakh ha (12.14 per cent of state) which sustains 122.90 lakh population i.e. 20.36 per cent of the state entailing much higher population density (513 persons/km<sup>2</sup>) than the Gujarat state (308 persons/km<sup>2</sup>). Thus the food demand of South Gujarat will always be higher than the state in coming years. Further rising per capita income in South Gujarat will lead to increase the demand of high value rich food. Therefore, it will be our focus not only to increase the food but also improve its quality and value in near future.

To fulfill these requirement concerns like infrastructure, value addition, processing and marketing chain for perishable commodities needs to be addressed in systematic manner. The research for future would be emphasized on (i) to develop quality seeds and promising and cost -effective technologies to meet enhanced food grain requirement and (ii) to create infrastructure and cold marketing chain to minimize post harvest losses.

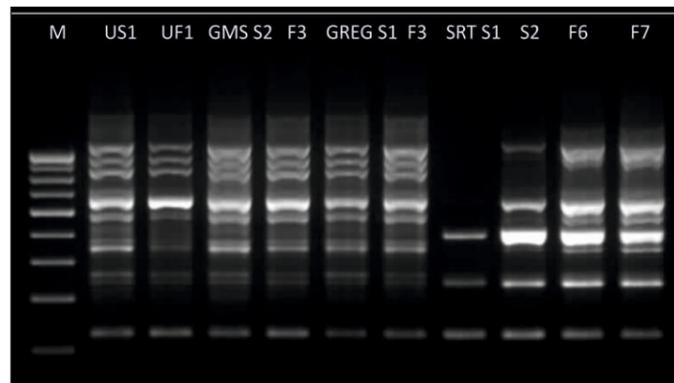
#### Climate change and agriculture

Climate change is the sole major concern of today's world. It is expected that global earth temperature would increase up to 4° C by the end of 21<sup>st</sup> century. Direct effects like extreme hot climate, floods, droughts, cyclones and recession of glaciers and indirect effects like altered dynamics of pest and diseases, altered physiology of crops and productive animals would be noticed. Maintaining the growth of food grains and other commodities would be a major single concern in future. South Gujarat is also witnessing effect of climate change like delayed onset of monsoon, unseasonal rains, torrential rains, rising temperature and cold. Another major concern of South Gujarat is floods which largely affects economy of farmers. However, strengthening of forecasting system may mitigate losses caused due to unseasonal rains and floods by predicting accurate sowing and harvesting time for a particular crop. Therefore, the present situation forces us to take research project on study of climate change and to find or develop crops and productive animals adopted in extreme hot and adverse climate and technologies to mitigate the same.

#### Technology Landscape

The most important factor in enhancing agricultural production is genetic improvement of crops to increase productivity and to meet increased demand of agricultural produce. There is wide scope of genetic improvement for enhancing productivity of various crops and providing inbuilt resistance to biotic and abiotic stresses but also developing technologies suitable for changed climate and capable of low input use efficiency. Thus improved crops will reduce input cost and make agriculture more profitable and sustainable. To meet the above said objectives, probably enhanced and specific use of molecular biology, biotechnology, nanotechnology targeted mutations and geo spatial technology would play an important role in future. The country already has developed huge bank of precious genetic material of various crops. NAU has been working on genetic improvement of cotton, sugarcane, rice, pulses, sorghum, hill millet, mango, sapota and banana since long. However, further research on mandate crops with updated technologies

would be focused to enhance the productivity up to the international standards.



#### Emergence of Agri- business

Globalization of Agri-market opened opportunities for exporting food grains and processed food but also posed challenges in the name of stringent food safety norms. Globalization also dictates to produce crops at competitive price. Many corporate in the country have already entered in agri-business through the commodity trading and competing in the international market. Thus agriculture is slowly turning from traditional low profit farming to contract and highly profitable business in Gujarat. As far as agribusiness and supply chain is concerned, very good infrastructure is available in Gujarat. More than 200 APMCs and 401 market yards with agro processing units for cotton, oil, rice, pulse, tobacco, sugar and dehydration units for onion and garlic are available for Agri-business in Gujarat. Additionally, there are three major ports (Kandala, Mundra and Pipavav), four special yards for cotton, tobacco, spices and groundnuts and a first class road network throughout the state.

In Gujarat, dairy and animal husbandry sector is also very well developed as there are 12 district milk producers union, 13,761 milk co-operative societies with 20.84 lakh members. Milk production of Gujarat is estimated to be about 150 lakh liter/day, the available infrastructure is however sufficient enough to handle the huge amount of perishable milk.

Government of Gujarat setting up agri-export zones for fruits and vegetables as international standard. Gujarat Government has also planned to set up perishable air cargo complex at Ahmedabad International airport to facilitate inland and export of commodities. Simultaneously, food testing laboratories are being set-up in all the four SAUs of Gujarat to take care of quality control.

### Agricultural Research System

Navsari Agricultural University (NAU) was established by the Government of Gujarat by enactment of GAUs act 2004 w.e.f. 1st May, 2004.

Academic activities were started way back in the year 1965 with establishment of N.M. College of Agriculture There after; Aspee College of Horticulture and Forestry was established in 1989. After attaining the independent status of Navsari Agricultural University, Post graduate Institute of Agribusiness Management in 2007 and College of Veterinary Science and Animal Husbandry in 2008 were established. Other than academic activities, NAU has a strong research set-up in the term of 15 research stations viz. two zonal ( Navsari and Bharuch), three main ( Surat, Paria and Navsari) and 10 sub centers or verification centers ( Tanchha, Achhalia, Hansot, Mangrol, Dediapada, Vyara, Waghai, Bardoli, Gandevi and Vanarasi).

University has an organized extension set-up comprising of 4 Krishi Vigyan Kendra's, five Polytechnics, Sardar Smruti Kendra, ATIC, Fisheries Training Center, Water Management Training unit, Bakery School, Gardening and Landscaping Training Center and Livestock Inspector Training Center for transfer of technology. Middle level technicians are also produced through various polytechnics and certificate courses to fulfill needs of rural enterprise and development of self employment in the rural youth.

For organizational set-up and modus operandi of governance, ICAR Model Act has been adopted with reference to the appointment of the Vice Chancellor, Constitution of Board of Management, Academic Council, Research Council, and Board of Studies besides implementation of recommendation of Dean's committee reports for course curricula and academic program. Decision making, policy planning, monitoring and evaluation are coordinated by the Research Council, Extension Education Council and Finance Committee.

#### Mandate of University

1. Imparting higher and lower education in different faculties viz., Agriculture, Horticulture, Forestry, Veterinary Sciences and Animal Husbandry, Agribusiness Management, Agricultural Engineering and Technology and other allied sciences like Food Processing Technology, Biotechnology etc.
2. Further advancement in research and development in crop science, horticulture and veterinary sciences and animal husbandry
3. Implement innovative extension education programmes for transfer of technology.
4. Such other academic and research programmes as the University may initiate from time to time based on the location specific need and demands.
5. Produce high quality seeds for major crops of the area
6. Popularize production technology to end user.

**Achievements**

Crop variety and agro techniques recommended for the farmers

Discipline	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Crop	1	1	3	4	4	3	3	19
Improvement								
Natural Resource	15	6	17	11	18	12	17	96
Management								
Horticulture	2	-	2	5	9	1	1	20
and Forestry								
Plant Protection	1	7	4	4	3	6	8	33
Agril. Engineering	2	-	1	1	2	1	1	08
Basic Science	-	2	1	-	-	-	1	03
/Social Science								
Total	21	16	28	25	36	23	31	180

The recommendation for NRM includes INM, efficient use of water and fertilizer through pressurized irrigation system, cost cutting techniques in MIS, weed management, protected cultivation, low cost polyhouse, precision farming, SIRA technology, land configuration and tillage for high yield and efficient use of inputs for different crops. Some of the technologies like mulching, MIS, drainage, low cost polyhouse etc. have been widely adopted by farmers.

Pest diseases pose serious threats to crop protection in South Gujarat, where high humidity and temperature provide congenial conditions for their multiplication. The recommendations encompass IPM, IPDM, pest dynamics, chemical and biological control measures for mandate crops of the region. Pheromone traps designed by NAU for fruit flies have wide acceptance amongst farmers.

South Gujarat the fruit basket of Gujarat is known for its mango, sapota and banana. The recommendations are made for rejuvenation of old sapota and mango orchards, high density planting in mango, INM and intercropping of vegetables in banana, value addition in flower crops for higher returns to the cultivators.

**Varieties Released/endorsed by NAU:**

Sr.No.	Name of Crop	Variety
1	Rice	02
2	Sorghum	01
3	Nagli	02
4	Vari	01
5	Pigeonpea	02
6	Indian bean	01
7	Green gram	01
8	Cotton	03
9	Sugarcane	04
10	Turmeric	01
11	Banana	01
	Total	19

**NAU 2030**

South Gujarat has diverse agro climatic conditions viz... heavy and medium rainfall area, fertile and saline land, undulated hilly tract, urbanized and industrialized area, forest land, irrigated and rain fed cultivated land. There are pockets of heavily populated and scantily populated areas dominated by urbanized and tribal population. South Gujarat is also known as fruit basket of Gujarat as mango, sapota, banana, papaya and vegetables and flowers like Gerbera, roses etc. are grown here and marketed throughout the country.

Prevalence of diversity factors depicts a complex picture of agricultural and allied fields. NAU faces variety of challenges like ingress of seawater along the coastal belt, water logging in canal command, soil erosion, imbalance and use of macro and micro nutrients stagnant productivity of mandate crops, climate change, diminishing land holding, scanty availability of labor, decreased productivity of age old orchards, depleting forest cover. With this background, NAU look forward to double the income of farmers by increasing productivity using pest and disease resistant crop varieties, development of saline and water logging resistant crops to increase cultivation area, reduction of input costs, minimizing post harvest losses, post harvest technologies for value addition and production of export quality products. Long coast line also provides ample opportunities for development of aquaculture and fisheries. Similarly, water logging in heavy rainfall areas provides opportunity for inland fisheries. Declining land holdings in peri-urban areas encourage animal husbandry e.g. goat rearing in tribal dominated area to enhance income of tribal and/or vegetable farming for fast and higher income. Thus, efforts of NAU would be towards becoming a leading organization in South Gujarat to fulfill the demands of stake holders.

**Vision:**

Transform Navsari Agricultural University into a Knowledge Power Centre by the year 2030

**Mission:**

Attain excellence in education, relevance in research and outreach in extension education.

**RESEARCH OBJECTIVES**

- Enhancement of genetic yield potential through conventional and biotechnological tools of mandate crops of South Gujarat.
- Develop GM cotton for resistance to pests, weedicide and other adversities.
- Evolve need based location specific, remunerative, productive, sustainable, eco-friendly and scale neutral technologies for different agro-eco-socio economic situations of South Gujarat.
- Develop technologies for rejuvenation, reclamation and conservation of natural resources with bio-fertilizer and bio-pesticides.
- Evolving modern agricultural practices, value addition and processing technologies for increasing the Total Factor Productivity of various agriculture occupations like Horticulture, Floriculture, Animal husbandry and Inland - Fisheries.

- Production of Breeders', Foundation and Certified seeds/grafts/seedlings/tissue culture plantlets of the mandate crops to assure higher yield, pest and disease resistance and quality.

#### THRUST AREA OF RESEARCH

- Genetic enhancement of niche crops for yield, quality and biotic / abiotic stress tolerance / resistance through conventional and biotechnological approaches.
- Plant Biodiversity protection and conservation especially of plants of medicinal value.
- Natural Resource Management including promotion of water use efficiency and multiple use of poor quality water.
- Improvement of drainage system to prevent water logging and secondary salinization.
- Developing precision farming technology for mandate crops.
- Weather forecast and climate change modules using GIS technology.
- Research on organic farming
- Develop bio-fertilizer and bio-pesticide products for enhancement of productivity and avoid losses due to diseases in eco-friendly manner.
- Post harvest technology
- Development of technology for extraction of food grade phytochemical viz., lycopene, curcumin, bixin and capsaicin from tomato, turmeric, annatto and chili, respectively.
- Bioremediation of heavy metal contaminated soils
- Diagnosis and management of plant viral diseases.
- Development of eco-friendly bio-control modules.
- Protected cultivation of ornamental plants and vegetables.
- Application of nanotechnology.
- Research on agro-marketing.
- Promotion of Farmers Participatory Research Programs for INM, Drip, in-situ moisture conservation and weed management.
- Design and development of client focused extension education / training programmes
- Development of improved production technology for newly developed varieties and hybrids including INM and cropping system.

### *Harnessing Science*

The ultimate responsibility of NAU towards agriculture is to enhance quality and quantity of food grains, pulses, cotton, oilseeds, sugarcane, vegetables, fruits, milk, eggs, meat and fish in South Gujarat This would be possible by increasing productivity, increasing area of cultivation (by developing saline and water resistant varieties), enhancing input use efficiency, reducing input cost, minimizing post-harvest losses through conventional techniques as well as new science and tools.

In the present scenario, technological challenges are complex because of increasing demand for food and simultaneously decreasing land resources due to expanding infrastructure, urbanization and SEZs. Fortunately, science is also changing rapidly like molecular nano-biology system, biotechnology; geographic information system etc. For faster and targeted results, NAU has geared up itself to put these sciences into practical use.

#### Potential of genetic resource enhancement

Research on genetic alterations of crops, plants and animals has been focused over last several decades in India to enhance productivity. Same things will be given greater importance in coming years too, however, involving newer technologies would make the task bit easier. As we have optimized productivity of various crops, our goal will be to make crops disease resistant using genetic engineering just to reduce input cost and making agribusiness more profitable. Future demands will be addressed by optimum use of available genetic resources and exotic germplasm within the framework of CBD. The main point of attraction of future research would be development of trait specific transgenic, with the help of re-breeding, functional genomics, proteomics, gene mining and molecular breeding using marker aided selection and gene stacking.

#### Synergies of frontier sciences

It is well known fact that 21<sup>st</sup> century belong to information and communication technology. Since, agricultural profession is directly related to nature's influence, communication technology, remote sensing, geographic information system (GIS) and global positioning system (GPS) will jointly play an important role in planning agricultural operations, cropping system and crop management. Thus developing science will help in mitigating losses caused by natural forces.

These newer developing sciences will prove to be a great boon to South Gujarat which lies close to sea and many major and minor rivers traverse through its jurisdictional area. Proper use of remote sensing and communication technology will save millions of rupees of farmers lost during floods, cyclones and heavy rains.

#### Management of natural resources

Availability of land for cultivation and water for irrigation are the vital factors of agriculture. However, both these resources face stiff challenge from expanding population, urbanization, industrialization and infrastructural developments, same trend will be

witnessed in future. And therefore, agriculture is encountering severe competitions from these sectors. Looking to present scenario, it is mandatory to promote rain fed agriculture by managing soil and water scientifically and efficiently. To optimize use of available water micro irrigation needs to be given priority in future. Simultaneously, integrated crop management, integrated nutrient management, integrated pest management and integrated water management needs to be given wider acceptability by farming community. NAU has undertaken wider use of bio-fertilizers, bio-pesticides, vermi-compost and bio-compost to sustain soil health in South Gujarat. There are few villages in South Gujarat where gobar gas plants are working efficiently for domestic use. Such eco-friendly agricultural activities will be widely promoted in other parts of South Gujarat. Government of Gujarat already completed soil testing in 18618 villages of Gujarat and issued soil health cards to over 12 lakh farmers. Based on soil testing report, cropping system, quantity and type of fertilizer will be decided to optimize productivity in future in South Gujarat.



**Agricultural diversification**

With increasing urbanization, industrialization and individual income there is constant pressure to increase both quantity and quality of various commodities. Further, demand of organic food grains, pulses, oil, vegetables and fruits are increasing at a faster rate in the society. Thus agricultural research needs to be perfected to meet the demand of quality as well as quantity of food. Therefore, besides development or improved genotypes and management practices for raising productivity of high values commodities in different agro climatic conditions, consumer-preferred quality traits and food safety would be given top priorities in future. Gujarat state recently initiated agri-export zones for mangoes, vegetables, agro-industrial policy to support agro export and processing of agro products, food testing laboratories at SAUs. Moreover, Gujarat has large ware housing capacity and cold storage chain to promote agriculture in the state.

**Post harvest and value addition**

Agri-marketing in India is unorganized and inefficient; losses as high as 18-25 percent occur in the entire food supply-chain from production to consumption. As far as agricultural marketing organization is concerned, there are 200 APMCs, 401 market yards agro processing units for cotton, oil, rice, pulses, tobacco, sugar and spices. Additionally,

four special markets are being created for fruits, spices, vegetables and flowers. Gujarat also has large warehousing capacity and cold storage chain.

In spite of this infrastructure there is lot of opportunities to minimize post harvest losses particularly of perishable items. Small-scale post-harvest units need to be developed in a cluster of 4-6 villages to produce value added product in village itself to increase the income of farmers, to avoid loss of profit in long supply-chain and to generate employment. By and large, collection, processing and distribution channel which is developed for milk producers union needs to be developed for vegetables and fruits.

**Management of energy and agricultural waste**

Energy crisis is biggest concern of today's world; expanding industry is competing with agriculture for energy supply. Therefore, opportunities need to be explored for conserving energy for agricultural sector. Alternate sources of energy like wind and solar energy can be utilized at farm level provided it is made cost effective. The biggest opportunity lies with the production of energy by utilizing biomass and bio waste. This will not only provide quality manure for farming but gases produced during process may be utilized as a substitute of electrical energy in villages. Large scale production of bio fuel by using agricultural waste would be a great boon to rural population. These facts should form a basis for research on bio fuel parallel to agricultural research.



**Bio-risk management**

As climate change is expected to change the dynamics of insects and pests in future, we should plan for intensive monitoring for such changes. However, effective communication system and geographic information system and bio-risk intelligent system



may help effectively in bio-risk management. All the different systems need to be effectively co-ordinated at national level to minimize bio-risk across the country.

#### **Institutions and policies**

As land holding is decreasing day by day and quality of soil is deteriorating due to loss of vital nutrients, it is right time to redesign agricultural policies suited to small holders of nation. Secondly, stringent legislation needs be enforced to curb fake agro industries and to control selling of sub standard seeds, pesticide and fertilizers.

#### **Education and human - resource development**

Implementation of new research programs and recent technologies for modern agriculture require qualified and competent human resources and financial assistance. Under the era of WTO, agricultural products of our country must be of international standards fulfilling all pre-requisites. Further, the cost of production should also be lower than other countries to avoid competition. Thus to produce agricultural products in international market latest infrastructure and qualified personnel will be required in India. To meet the above challenges NAU would play an important role in providing highly qualified manpower in the field of agriculture, horticulture, forestry, biotechnology, veterinary science and animal husbandry and agribusiness management. NAU is planning to start short term courses in the field of seed production, bio-fertilizer and bio-pesticide, post harvest technology and tissue culture to provide and implement technologies at grass root level.

#### **Technology transfer**

If it is important to develop new technologies for mankind then transfer of technology for wider use is still more important. NAU plays an important role in transfer of technology through its extension network, news and print media on regular basis. Gujarat government also plays a vital role in transfer of technology by arranging mass communication programme in the name of Krishi Mahotsav every year, which covers 18000 villages of Gujarat including 3682 villages of South Gujarat. However, with the increase in the literacy rate university would prefer electronic media for mass communication and forecasting.

High tech institutes of agriculture, horticulture and veterinary sciences needs to be developed in the form of centre of excellence or centre for advanced training to generate latest information and scientific support for the benefit of farmers of South Gujarat. Simultaneously, efficient machinery for transfer of technology needs to be established for prompt and accurate dissemination of scientific information.

In the era of high tech information and communication technology, NAU would prefer video conferencing and SMS by using cell phone for dissemination of information to the stakeholders of South Gujarat.

### **Strategies and Framework**

#### **I. Generate qualified and competent human resources**

- Highly skilled manpower in the field of agriculture, forestry, horticulture, fisheries and veterinary sciences to meet the demand of agriculture, education, research and proliferating agribusiness at national and international level.
- Middle level technicians to fulfill the requirement of seed, fertilizer, pesticide, industry, banks, cooperatives and other agricultural commodity trading enterprises.
- Inculcate entrepreneurship skill in students for agribusiness/services.
- Develop professional, responsible and motivated personnel.

#### **II. Demand driven technology development and intervention**

- Genetic enhancement of mandate crops of the area using conventional and modern biotech tools to meet the burgeoning population demand of food, feed, fuel and fiber.
- Induce tolerance/resistance to biotic and abiotic stresses.
- Enhance input use efficiency for sustainable crop productivity and soil health.
- Integrate traditional wisdom and modern technology for production and protection technology.
- Initiate research programme in frontier areas such as environmental sciences, nanotechnology, biodiversity etc.
- Technology for farm waste and by-product utilization for developing value added product and employment generation.
- Intensify research in post harvest technology.
- Strengthening and moderation of laboratories.
- Generation of technology for food and nutritional security of large tribal population.
- Initiate research on aquaculture for efficient resource utilization and augmenting farmers' income.
- Upgrading research and out reach in animal health, dairying, goatary and poultry.

#### **III. Disseminate of improved technology and sharing of knowledge and information**

- Strengthening existing extension system.
- Improving communication, awareness and sensitization for dissemination of technology and feedback.

#### **IV. Intellectual property right issues and effective evaluation system**

- A compatible intellectual property and management system needs to be developed/strengthened in the interest of scientific community, farmers and society.
- Implementing procedure of intellectual property rights.

## Epilogue

The Navsari Agricultural University a young farm varsity since its establishment in 2004 is an institution dedicated to the development of demand driven technology to fulfill and improve the livelihood conditions and aspiration of the people depending upon agriculture based economy in South Gujarat. With long coastal line, hilly undulated tract, irrigated fertile plains, salt affected soils, low rainfall to high rainfall areas and highly industrious to tribal population. South Gujarat possess spectrum of challenges and opportunities to the farming community and agricultural scientists, as well. The NAU firmly believes that education, research and development in agriculture would transform the slowed economy of South Gujarat into a vibrant economy which would augment farmers' income, generate employment opportunities in rural and urban areas, conserve natural resources, promote aquaculture, floriculture, minimize wastage of agricultural produce through processing, value addition and promote exports for higher and inclusive agricultural growth in this region. The impact of research innovations in crops like cotton, pigeon pea, paddy, sugarcane, sorghum, millets, banana, mango, sapota and vegetables along with fisheries and animal husbandry would open new vistas for harnessing under exploited domestic and even foreign markets. The NAU would make all out efforts to cater to the needs of large poor, illiterate tribal farming community, on one hand and highly industrious, educated and technology savvy people, on the other. The university would venture in big way into some new arena like bio-fertilizers, bio-pesticides production, high-tech horticulture, by-product utilization, biotechnology on its own and/or participatory mode for the benefit of stake holders at the national as well as international level. The university would generate highly skilled human resources in specialized area of agriculture, horticulture, forestry and veterinary as well as middle level technicians. The NAU will also focus on administrative reform, accountability and responsibility in next two decades.

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