Vision 2050

॥ कृषिमूलम् जगत् सर्वम् ॥

Junagadh Agricultural University
Junagadh - 362 001 (Gujarat), India

Vision 2050

JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH - 362 001 (Gujarat)

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Director of Research & Dean, PG Studies
"University Bhavan"
Junagadh Agricultural University,
Junagadh-362001 (Gujarat)
Phone: (0285) 2670131
Fax: (0285) 2674064
E-mail: dr@jau.in

Edited & Compiled by:

Dr. V. P. Chovatia
Dr. V. V. Rajani
Dr. Pramod Mohnot
Dr. K. B. Parmar
Dr. R. K. Mathukia
Dr. B. Swaminathan
Er. D. B. Barad
Shri M. D. Sangani

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R. C. Faldu

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No: Agri, R.Dev & Trans./ 4460/19
Minister,
Agriculture, Rural Development and Transport,
Government of Gujarat
Swarnim Sankul-1, 2nd Floor,
Sachivalaya, Gandhinagar-382 010.
Date: 25 NOV 2019

"Message"

It is pertinent to note that the ultimate goal of farming is not the growing of crops, but the cultivation and perfection of human beings. Indian agriculture has perfected this art very well and continues to be the bulwark of the social and cultural fabric of the country. Thereby, in no certain terms, the contribution of agriculture to the country's economy can be limited to its gross domestic product alone since it transects every other finer element of land and its people. In the future too, agriculture would continue to be the symbol of India's strength and sovereignty.

Gujarat state is both the pioneer and leader in India when it comes to realizing the prospects of farm-oriented growth and development. Backed by an unmatched 10 per cent agri-growth rate throughout the last decade, Gujarat has made substantial strides in agriculture despite the severity of the challenges posed by the vagaries of monsoon and deficit rainfall. Particularly, the state has emerged as the major producer of cotton, groundnut, castor, seed spices, milk and marine products. Moreover, it is one of the few states in India wherein the doubling farmers' income by 2022-23 is in the realm of possibility. This is no mean achievement and it has happened with the active collaboration and the right kind of synergy existing between the scientists, policy makers, administrators and our enterprising farmers.

In this context, I am pleased to note that the Junagadh Agricultural University has come up with a detailed strategy document entitled "Vision 2050" which happens to be a well-balanced road map for ensuring all round growth and development of agriculture in the Saurashtra region. I am confident that the JAU Vision 2050 will be of unequivocal assistance to the researchers, policy-makers, farmers, administrators and development professionals alike in harnessing the latest developments of science and social-wisdom towards ensuring food, feed, fuel, income, livelihood and sustainable environment.

(R. C. Faldu)

To,
The Director of Research
Junagadh Agricultural University,
"University Bhavan"
Junagadh-362001

Punamchand Parmar, IAS
Additional Chief Secretary
Government of Gujarat
Agriculture, Farmers Welfare
and Cooperation Department

Message

The contribution of Gujarat state has been stupendous in scripting the country's success in agricultural domain. Even in the sun-rise sectors like that of dairy and marine, the state of Gujarat has performed extremely well and is leading the country with models worth emulating not only among different states but also in other countries as well. The policy-making and administrative bodies of the state have always worked in tandem for materializing the real-time needs of the farming community. The achievement of a decade-long agricultural growth rate of 10 per cent is a standing testimony to the existing synergies among different bodies of the state. Besides, the Government of Gujarat has always been instrumental in assuring several revolutionary schemes for agriculture including water conservation movements through check dam, promoting rural electrification through *JyotigramYojana*, leveraging horizontal transfer of technologies through *Krushimahotsavas* and harnessing of solar energy by *Suryashakti Kisan Yojana.*

At the same time, we have to keep us prepared to face various next-generation challenges and most of them will be linked to food security and food safety of the exploding population. India is going to be most affected as its population is expected to cross 1.7 billion by 2050. On the other hand, problem of abundance often surfaces where the farmers fail to realize minimum profit for their produce. Such new-generation challenges need to be countered with new-generation strategies. But strategies do not happen over-night, they need to be toiled-upon. And for them to become actionable, they have to be calibrated well-before and executed in a phased-manner in such a way that the impending consequences get neutralized or at least minimized.

I am extremely happy to find that the Junagadh Agricultural University has trained its thoughts in this line and brought out 'Vision 2050'. This remarkable document is a showcase of the preparedness of the University in not only addressing the upcoming challenges but also in achieving optimal utilization of the resources so as to ensure sustainable production and sustained farm profitability in the Saurashtra region of Gujarat state. I congratulate the whole team of JAU Vision 2050 for crafting the blue-print for a successful and sustainable farming. I sincerely hope that this action document will benefit not only the farmers of the Saurashtra region but also the appropriate strategies listed will be found good enough to be replicated for the benefit of the farming community across the state and ultimately the entire nation.

Gandhinagar
12 December, 2019

(Punamchand Parmar)

To
Director of Research
Junagadh Agricultural University,
University Bhavan,
Junagadh-362001

Phone: (079) 23250801, 23250803 Fax : (079) 23252365 E-mail : secagri@gujarat.gov.in

Former Vice-Chancellor,
Junagadh Agricultural University,
Junagadh 362-001

Message

The eternal shloka from Mahabharata can also be augmented as: ''कृषि रक्षति रक्षित'', thereby, profoundly implying that 'agriculture will save those who in turn save or uphold agriculture'. And, the role of Indian agriculture is not just about serving the country and its ever burgeoning population but is also in saving the country from the need to spend billions and trillions of foreign exchange to import food commodities. From time to time, the scientific fraternity in agriculture and the farming community in particular have always risen up to the occasion to serve the country with a myriad of agricultural revolutions from green to blue to yellow to golden. Every single rupee invested on agricultural research, education and extension has always turned out to be extremely productive for the country. As put forth by the World Bank 2008 report, using 1981-2003 gross domestic product (GDP) data from 42 developing countries, every 1 % GDP growth originating from agriculture sector is 2.9 times more effective in raising the income level and standard of living of the poorest-of-the-poor when compared to other sectors.

In the present times, agricultural development is constrained with several challenges related to natural resource degradation, implications of climate variability, diversion of agricultural land to non-agricultural uses, issues related to intellectual property rights, escalating cost of cultivation and farm profitability concerns. In this connection, the JAU Vision-2050 document has been brought out by embodying a pragmatic assessment of the ongoing as well as the futuristic challenges concerned with production, marketing, sustainability and profitability of agriculture and its allied enterprises in the Saurashtra region. Taking due cognizance of the rapidly evolving national and international agriculture issues, JAU has come up with its Strategic Framework for agricultural growth and development in the region by clearly listing out the requisite Goals, Approaches and Performance Measures. In short, the future readiness of the University is aptly captured by this vision document. My best wishes & congratulations to the entire team for having prepared the document with utmost dedication and sense of commitment.I sincerely hope that the University will scale even greater heights in the times to come.

Junagadh
November, 2019

(A. R. Pathak)

Vice-Chancellor and
Director of Research & Dean (PG Studies)
Junagadh Agricultural University,
Junagadh 362-001
Phone: (Office) +91-285-2671784
Fax: +91-285-2672004
Email: vc@jau.in

Foreword

"Vision without action is just a dream, action without vision just passes the time, and vision with action can change the world." Such words of the South African Gandhi and Nobel Laureate, Shri. Nelson Mandela, resonates and augers well to any domain that has the potential to change the world. Indian agriculture is not only the saving force for the country's population from the issues of food security and malnutrition but also the saving grace of the country itself in terms of its sovereignty and foreign exchange. Despite, characterized by the erratic and uncertain rainfall coupled with the large inter-annual rainfall variability, hard rock hydrogeology and groundwater exploitation the farmers of Saurashtra region have set records in agricultural production. Livestock and fisheries sectors also play key role in uplifting farming community. With improved varieties and improvements adopted in crop cultivation practices; Saurashtra region has become a dominant force in the cultivation of cotton, groundnut, sesame, wheat, seed spices, vegetables and fruit crops, etc.The role of Junagadh Agricultural University has been phenomenal in addressing the real-time needs and the most-pressing challenges of the farming community in the region. At the same time, it is to be understood that after climbing a great hill, one only finds that there are many more hills to climb.

As a part of its farmer-first attitude and continuous strive for excellence, Junagadh Agricultural University makes it mandatory to conduct brain storming sessions for bracing itself to meet the future challenges and, thereby,overhaul its strategy time-to-time for betteringagricultural growth and development through agricultural education, research and extension activities. The VISION 2050 document has been visualized and prepared keeping in mind fuller utilization of JAU's existing capabilities/infrastructure coupled with deeper and broader collaborations and consortia with a trans-disciplinary approach by engaging the best brains. There remains a big array of such

parameters which will be attempted thorough enormous activities in the domain of research, education and knowledge disseminations for creating quality human resources and their employability. Accordingly, the VISION 2050 document includes focused descriptions of 'Current Agricultural Status of Saurashtra, 'JAU–Current Status', 'Strengths & opportunities', 'Strategies & Framework' and 'Way forward'. The document lays down the important thrust areas and strategies to incorporate the discipline-wise identified measures for better outcome of the University activities.

I thank ourformer Vice Chancellor Dr. A. R. Pathak for his inspiring leadership and for instilling a sense of ownership among the entire JAU family leading to the conception and preparation of the Vision 2050 document of the University. I appreciate untiring efforts made by all the conveners of various chapter-wise subcommittees and the members, which has enriched the document. I am confident that VISION 2050 would help the researchers, academicians and extension educationists of JAU to improvise upon their scientific and academic inputs and thus contribute in JAU's increasing visibility at the national and international levels by keeping pace with the time and ever changing agricultural scenario.

Junagadh
November, 2019

(V. P. Chovatia)

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JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH- 362 001 (GUJARAT-INDIA)

1.0 Prologue:

Economic growth and trade prospects are fast transforming India's position in the world from a developing economy to a middle-income economy. Since 2010, India continues to be a trillion dollar economy. And, with a nominal gross domestic product (GDP) of US$ 2.62 trillion in 2017-18, our country has become the world's sixth largest economy overtaking France. We are also the third largest economy in the world in terms of purchase power parity. To top it all, with a 7.5 % growth rate, we are already the world's largest growing economy easily surpassing China. Further, the Indian economy is also projected by the World Bank to surpass the economies of United Kingdom and Germany and become the World's fourth largest economy in terms of nominal GDP by 2022. Incidentally, the year 2022 (the 75th year of our Independence) is also the target period for doubling farmers' income in India. Besides, the country's agricultural exports have also been earmarked to cross US$ 100 billion by 2022 from the present level of export value of US$ 30 billion.

It is beyond any doubt that agriculture is the lynchpin to the socio-economic fabric of India and occupies the centre stage in the country's welfare system. It is the single most source of livelihood for more than 58 per cent of India's population. Indian agriculture is a diverse and most extensive sector. Since Independence, the country has witnessed significant increase in several key commodities such as food-grains (green revolution), oilseeds (yellow revolution), milk (white revolution), fish and marine products (blue revolution) and overall horticulture (golden revolution). Despite the share of agriculture in GDP has decreased from more than 50 % in the 1950s to less than 14 % in 2017, the overall gross value added (GVA) by agriculture, forestry and fishing is estimated US$ 275 billion in 2017-18, whereas the gross domestic product (GDP) of agriculture and allied sectors is estimated to be US$ 367 billion in the same period. Globally, India is the largest producer of cotton, milk and pulses; second largest in foodgrains, fruits, vegetables and fish, besides third largest in egg production in the world. The production of horticulture crops are at a record

307.16 million tonnes in 2017-18 surpassing the total production of foodgrains. In terms of exports, India is the seventh largest exporter and the total agricultural exports from India has grown at a rate of 16.45 per cent per annum during 2002-2016 to reach US$ 38.21 billion in 2017-18. India has emerged as the largest producer, consumer and exporter of spices and the spice exports from India alone amounted to US$ 3.1 billion in 2017-18.

1.1 Agriculture in Gujarat:

Coming to Gujarat, agriculture is not only a prominent feature of the state but also inextricably linked to its economy since Vedic civilization. As of 2015-16, agriculture is still found to engage nearly half of the rural workforce (52%) despite a decline in its share in the state net domestic product (SNDP) to less than 20 per cent. With only 6.2 % of total geographical area and 5 % of the total population of India, Gujarat contributes on an average 21 % of India's exports, 11 % of its industrial production and not less than 6.5 % of the nation's GDP since 2011-12. The state of Gujarat has also made several remarkable and consistent achievements in agriculture. It is the dominant producer of cotton, groundnut, dates, sugarcane, milk & milk products and tobacco in India. Other major crops produced in Gujarat are rice, wheat, jowar, bajra, maize, pigeon pea and gram. Castor, groundnut and mustard are the important oilseed crops of the State. Cotton is an important cash crop of Gujarat covering 27.97 lakh ha and production of 98.72 lakh bales during 2014-15 which is approximately one-third production of the country.

Besides, Gujarat has recognition for highest area, production and productivity of castor comprising 12.98 lakh tonnes production (84% of total castor production of the country) from an area of 6.83 lakh ha. In addition, the State has a share of 30 % groundnut production in the country with 20.37 lakh tonnes production from 14.02 lakh ha. Area under cultivation of horticulture crops and production are also continuously increasing in the state. "Gir Kesar Mango"and "Bhalia wheat" have accorded unique GI identity in the country. State is also known for Cumin, Fennel and Isabgul production and productivity. State contributes more than 90% production of the country's Fennel. Gujarat has the highest productivity in country for Onion (25 t/ha.) and Potato (28.81 t/ha.). Besides, the state is 1st in the production of Cumin, Fennel and Date palm, second in production of Banana, Pomegranate, Sapota, Papaya and Lime. Productivity of Onion and Potato is the highest in the country. State enjoys monopoly in processing of Isabgol. The crop specific Centers of Excellence for the crops like Vegetables, Mango and Date palm have been established with the support of world best technologies with a view to increase the productivity and quality by

capacity building of the farmers. Couple of good integrated pack houses, air cargo complex and gama irradiation projects has been established by Gujarat Agro Industries Corporation. Out of the 90 active onion dehydration units in the country, 75 units are located in Mahuva (Bhavnagar), Vadodara and Gondal (Rajkot) alone with a production capacity of 11,250 tonnes per day.

Animal husbandry and dairying sector has played vital role in socioeconomic development of Gujarat state. Animal husbandry provides employment to every class of society and is also an important source of income for poor families of Gujarat. Gujarat is rich with various indigenous pure breeds including Gir and Kankarej breeds of cow; Mahesani, Surti, Jaffrabadi and Bunni breeds of buffalo; Marwari and Patanvadi breeds of sheep; Sirohi, Surti, Mehsani, Kuchchhi, Gohilwadi and Zalawadi breeds of goat; Kutchi and Kharai breeds of camel and Kathiawari breed of horse. Gujarat possesses 19 registered breeds (13%) out of total 151 registered breeds of the country. As per Livestock Census-2012, Gujarat possess 2.72 crore livestock contributing 5.30 % to the total 51.22 crore livestock population of the country. Gujarat has become the fourth largest milk producer in India with a production of 127.84 lakh metric tonnes. The state has attained notable 7.33% average growth rate in milk production during 2005-16. In addition, Gujarat continues to hold first position in the country as marine fish producer since 2010 and its production in 2017-18 was estimated to be 7.09 lakh tonnes. No doubt, fishery sector is touted to be the sunrise sector in the state.

Gujarat happens to be one among the few states in India where the farm incomes have improved and have the potential to improve further from both crop and livestock sectors. Micro-Irrigation and Soil Health Card schemes are being well implemented in the State and the water conservation efforts through construction of over 1.25 lakh check dams and water distribution efforts through intra-state river linking have started paying dividends. As a result, state has received No. 1 award for water storage for consistently last three years. In addition, Gujarat is both pioneer and leader in harnessing solar energy for irrigation purpose.

But the challenges to food security continue unabated. With a global population expected to cross 10 billion by 2050 in which India alone has to grapple 1.7 billion which is 17% of world population, hence, the growth and development in agriculture are pre-requisite not only for inclusive growth but also for social well-being of any country. Urgent has become the need to ensure safe and quality food and meet nutritional requirements of the population. This progress has to be carried out in the background when the world is to experience increasing water and land scarcity; soil,

land and biodiversity degradation and more frequent and severe weather events compounded by the implications of climate change and variability. In India, strategies are on the anvil to scale up irrigation; provide quality seeds and assuring nutrients based on soil health; ensure investments in post-harvest technologies; prioritize value addition prospects; modernize agricultural marketing system; and promote on-farm ancillary activities. Target oriented agricultural growth and development is the only way to serve food security in the future by addressing all forms of malnutrition, improving productivity and income of small-scale food producers, promoting resilience of food systems and ensuring sustainable use of biodiversity and genetic sources. In this context, it has become essential not only to assess the region-specific performance and deliverance of agricultural sector but also to formulate suitable strategies requisite to attain the sustainable development goals (SDGs) of 2050.

1.2 Saurashtra region:

Saurashtra region is a peninsular region of Gujarat state located on the Arabian Sea coast. With a total area of 66,000 sq. km, it covers one-third of the state's geographical area comprising the south western part of the state with 10 districts. The region is referred as Saurashtra since Vedic times and references to it are available in the Mahabharata as well. Despite having gone through several severe droughts during the 20th century, Saurashtra has been a flourishing region abundant in natural resources and its enterprising people. It is located on the West Coast of India in Gujarat and lies between 20^{0} 30' to 23^{0} N latitude and 69^{0} to 72^{0} E longitude. It is flanked by Arabian Sea on the western side, the Gulf of Kutch in the north and Gulf of Khambhat in south. The region has an irregular high land core. The low coastal strip is covered with sand and alluvium silt with the high land fringe by a 75 m contour, while the altitude rises up to 300 m and above to form different grades of surface. The entire region is surrounded by sea on three sides, while it is connected with main land of Gujarat to its east. The rivers that drain the area are Bhadar, Shetrunji, Shigvada, Raval, Ardak, Machhundri, Hiran and Bhogavo. Hills of Girnar, Palitana and Barda are noteworthy in the region. The natural eco-system include thorn-scrub forests, grassland (Vidis), dry deciduous and riverine forests, mangroves, inter tidal region and coastal area including estuaries. The total population of Saurashtra region is 14.96 million as per 2011 census with a density of 246 people per sq.km in 76 talukas spread over 10 districts. The overall literacy percentage in the Saurashtra is 75.44

1.3 Climate and rainfall:

Saurashtra has a tropical wet and dry climate with three distinct seasons *viz*. a mild winter from November to February; a hot summer from March to June; and a

monsoon season from July to October. The region faces adverse climatic conditions during the summer months with the temperature ranging from 28 ^{0}C to 43 ^{0}C, during winter, the temperature ranges from 10 ^{0}C to 25 ^{0}C. The entire Saurashtra region falls under dryland and drought prone area and the rainfall distribution has been extremely uneven and irregular in sporadic manner. The low pressure and depressions developing over the Bay of Bengal during monsoon months and their movements from north to north west leads to rains in this region. The monsoon usually commences by the middle of June and withdraws by the middle of September. About 10-15 per cent of the annual rainfall is received in June, nearly 40 per cent in July, 30 per cent in August and 10-20 per cent in September. The mean rainfall is found to be a little above 700 mm in Saurashtra with a coefficient of variation of 27.71 per cent (Table 1).

Table 1: Rainfall pattern in the districts of Saurashtra region during the last five years

Saurashtra districts/ Rainfall in mm	2013-14	2014-15	2015-16	2016-17	2017-18	Mean (in mm)	CV (%)
Amreli	901.20	537.10	782.80	687.90	596.00	701.00	20.77
Bhavnagar	933.20	495.80	556.30	642.90	596.10	644.86	26.36
Devbhoomi Dwarka	-	-	-	573.10	620.20	596.65	5.58
Gir Somnath	-	-	-	975.00	1056.80	1015.90	5.69
Jamnagar	934.10	541.50	450.00	729.40	668.60	664.72	27.95
Junagadh	1192.40	930.40	623.20	875.70	878.60	900.06	22.50
Morbi	-	-	-	360.20	952.80	656.50	63.83
Porbandar	1114.30	910.30	411.10	602.20	654.30	738.44	37.31
Rajkot	1028.00	509.20	588.70	579.80	822.30	705.60	30.53
Surendranagar	672.30	530.10	374.90	355.70	839.60	554.52	36.91
Saurashtra (Mean)	967.93	636.34	541.00	638.19	768.53	717.83	27.74

1.4 Soils:

The soils in Saurashtra range from shallow medium black calcareous to shallow medium black and are low in nitrogen, sulphur and zinc, medium in phosphorus and iron, and high in potassium. The soils of this region are diverse in nature which can be broadly classified into ten groups *viz.* (1) shallow black (Trap Basalt), (2) shallow medium black (Lime stone) (3) shallow to medium black (Sand stone), (4) medium black (Trap Basalt), (5) mix red & black (Lime stone), (6) deep black (Trap Basalt), (7) marine deposits, (8) coastal shallow, (9) coastal deep, and (10) stony (Trap Basalt).

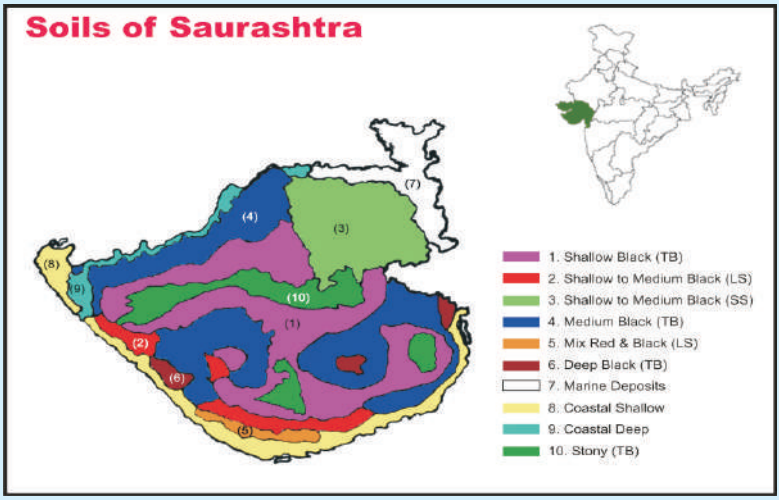


Figure 1: Soil groups found in Saurashtra region, Gujarat

1.5 Agrarian issues in Saurashtra region:

The major part of the Saurashtra region, falling under semi-arid and arid types with varying climatic as well as soil conditions, has been divided into two Agro-climatic zones. The agro-ecological characteristic features and the issues thereof have been discussed as follows:

- About 70 per cent of total area is rainfed and there is a wide variability in crop yields due to erratic and scanty rainfall with less number of rainy days.
- The economy is mainly based on the activities related to cotton and groundnut in crop sector and livestock and fisheries in the non-crop sector.
- The area and production of cereals and pulses are limited.
- The irrigated area is low which is through open wells and tube wells. However, the use of water conservation technologies *viz.* check dam, bori-bandh & khet-talavdi (farm pond) has recharged groundwater to a greater extent.
- In the adjoining areas of 788 km long coastal belt, sea water ingress and inland salinity have caused soil related problems.
- Due to industrial establishments in Saurashtra, the deposition of effluent water and heavy metal contaminants as well as mining near coastal region have posed socio-economic and ecological problems in Jamnagar, Porbandar, Junagadh and Bhavnagar districts.
- The cost of cultivation is relatively higher in the region since 80 % of

irrigation requirement of the region is met from groundwater.

- Despite huge potential, there are very less industries for value addition of agriculture and marine products.
- Limited cooperative and dairy sector in this region.
- Lack of market intelligence system for selling of agriculture produce.

1.6 Land use pattern:

As of 2014-15, out of the total geographical area of 196.8 lakh ha in the State, 93.11 lakh ha (more than 47 %) was under net cultivable area. About two-third of the area of the state falls under arid and semi-arid tropics and the rainfed area alone was about 66 lakh ha. The gross irrigated area in 2014-15 was found to be 50.72 lakh ha accounting for 46.46 per cent of total cropped area in which about 12.16 lakh ha was found to be saline and alkaline.

The total geographical area of Saurashtra region is 6.43 million ha representing 32.82 per cent area of Gujarat (19.61 million ha). Of the total geographical area of Saurashtra, 3.95 million hectares (61%) is estimated to be net-sown area. The cultivable waste land, current fallow, permanent pasture land, forest area, non-agricultural use and barren and uncultivable land accounted for 0.11, 0.27, 0.44, 0.39, 0.36 and 0.54 million hectares, respectively in Saurashtra region (Table 2 & Fig. 2a/b).The cropping intensity of Saurashtra region (100.46 %) was found to be lesser than that of Gujarat state (117.25 %). Predictably, irrigation intensity of the region (118.32) was also found lower than that of the state as a whole (146.33 %).

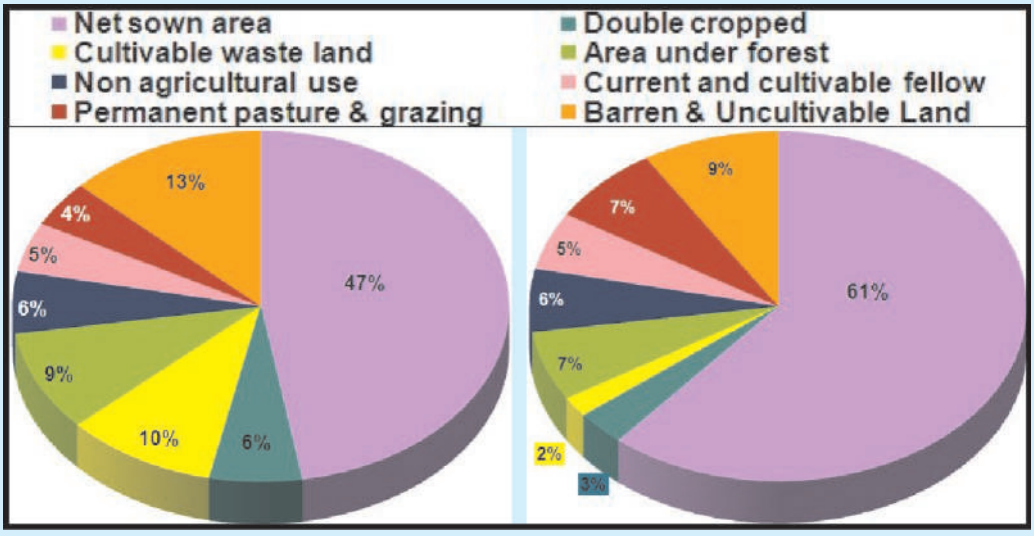


Figure 2(a): Land Use Pattern (%) in Gujarat

Figure 2(b): Land Use Pattern (%) in Saurashtra region

Table 2: Land use pattern of Gujarat state and Saurashtra region as of 2014-15

Land use category	Saurashtra region ('000 ha)	Gujarat State ('000 ha)
Total geographical area	6430.11	19680.12
Forest	395.82	1854.89
Barren and uncultivable land	539.54	2586.14
Land put to nonagricultural use	363.87	1149.83
Permanent pastures	440.36	850.15
Land under miscellaneous trees	0.02	3.85
Cultivable waste	111.59	1972.30
Current fallow	271.23	650.56
Fallow other than current fallow	12.63	19.41
Net area sown	3952.90	9310.54
Area sown more than once	383.39	1605.78
Total cropped area	4136.29	10916.33
Net irrigated area	864.59	3465.98
Gross irrigated area	1022.93	5071.76
Cropping intensity (%)	100.46	117.25
Irrigation intensity (%)	118.32	146.33

1.7 Agriculture in Saurashtra region:

Among the major crops in Saurashtra region (Fig. 4), oilseeds (groundnut, sesame and castor) occupied 51.52 % of the gross cropped area followed by cotton (33.87 %) and total food grains (19.47%). Other important crops grown in the region are spices (2.14 %), fruits (mango 0.88 % and sapota 0.26 %) and vegetables (brinjal 0.63 % & okra 0.37 %). In Saurashtra region, the major field crops are groundnut, cotton, wheat, bajra, sesame & cumin, while mango, coconut, citrus, sapota, guava & ber are the major fruit crops, and onion, cucurbits, brinjal, okra, tomato & cluster bean are the major vegetable crops (Table 3). The area under vegetables, fruits and spices foundto be increased during 2011-15 as compared to 2004-10. During the same period, the productivity of almost all the crops is increased to the tune of 2.43 % in onion to 31.37 % in flowers (Table 4 & Fig. 3).

Table 3: Major crops of Saurashtra region on the basis of their acreage

District / Rank	I	II	III	IV	V
Field crops					
Amreli	Cotton	Groundnut	Wheat	Sesame	Bajra
Bhavnagar	Cotton	Groundnut	Bajra	Sesame	Wheat
Devbhoomi Dwarka	Groundnut	Cotton	Sesame	Cumin	Wheat
Gir Somnath	Groundnut	Wheat	Cotton	Bajra	Castor
Jamnagar	Cotton	Groundnut	Sesame	Castor	Gram
Junagadh	Groundnut	Cotton	Wheat	Sesame	Gram
Morbi	Cotton	Groundnut	Sesame	Wheat	Cumin
Porbandar	Groundnut	Cotton	Gram	Wheat	Cumin
Rajkot	Groundnut	Cotton	Wheat	Castor	Cumin
Surendranagar	Cotton	Cumin	Castor	Wheat	Sesame
Saurashtra region	Cotton	Groundnut	Wheat	Cumin & Castor	Bajra
Fruit crops					
Amreli	Mango	Citrus	Sapota	Banana & Guava	Ber
Bhavnagar	Citrus	Mango	Guava	Coconut	Sapota & Banana
Devbhoomi Dwarka	Coconut	Papaya	Ber	Sapota	Mango & Citrus
Gir Somnath	Mango	Coconut	Sapota	Banana	Citrus & Papaya
Jamnagar	Pomegranate	Mango	Papaya	Citrus	Ber & Sapota
Junagadh	Mango	Coconut	Sapota	Banana	Citrus
Morbi	Citrus	Pomegranate	Ber	Mango	Papaya & Aonla
Porbandar	Coconut	Mango	Sapota	Ber	Citrus
Rajkot	Citrus	Pomegranate	Mango	Ber & Sapota	Aonla
Surendranagar	Ber	Citrus	Pomegranate	Mango & Guava	Sapota
Saurashtra region	Mango	Coconut	Citrus	Sapota	Guava & Ber
Vegetable crops					
Amreli	Mango	Citrus	Sapota	Banana & Guava	Ber
Bhavnagar	Citrus	Mango	Guava	Coconut	Sapota & Banana
Devbhoomi Dwarka	Coconut	Papaya	Ber	Sapota	Mango & Citrus
Gir Somnath	Mango	Coconut	Sapota	Banana	Citrus & Papaya
Jamnagar	Pomegranate	Mango	Papaya	Citrus	Ber & Sapota
Junagadh	Mango	Coconut	Sapota	Banana	Citrus
Morbi	Citrus	Pomegranate	Ber	Mango	Papaya & Aonla
Porbandar	Coconut	Mango	Sapota	Ber	Citrus
Rajkot	Citrus	Pomegranate	Mango	Ber & Sapota	Aonla
Surendranagar	Ber	Citrus	Pomegranate	Mango & Guava	Sapota
Saurashtra region	Mango	Coconut	Citrus	Sapota	Guava & Ber

Table 4: Comparative growth dimensions of major crops in Saurashtra and Gujarat state

Sl. No.	Crop	Period	Saurashtra			Gujarat		
			Area ('000 ha)	Production ('000 t)	Yield (kg/ha)	Area ('000 ha)	Production ('000 t)	Yield (kg/ha)
1	Groundnut	2004-10	1688.77	2312.64	1372	1881.66	2587.61	1378
		2011-15	1438.29	2453.84	1743	1499.44	2656.17	1765.28
	Increase/Decrease (%)		-14.83	6.11	27.02	-20.31	2.65	28.10
2	Bajra	2004-10	181.6	299.33	1670	815.53	1031.21	1273
		2011-15	78.95	163.38	1992	566.81	1142.12	2062.21
	Increase/Decrease (%)		-56.53	-45.42	19.26	-30.50	10.76	62.00
3	Castor	2004-10	46.51	120.73	2615	386.26	740.14	1907
		2011-15	122.05	271.57	2322	728.31	1489.81	2045.86
	Increase/Decrease (%)		162.42	124.94	-11.21	88.55	101.29	7.28
4	Cotton	2004-10	1393.04	883.49	631	2308.88	1295.37	559
		2011-15	1834.03	5834.07	554	2750.61	8500.12	525.72
	Increase/Decrease (%)		31.66	560.34	-12.24	19.13	556.19	-5.95
5	Gram	2004-10	65.02	83.2	1252	166.53	159.71	953
		2011-15	59.77	87.45	1455	172.51	184.71	1054.11
	Increase/Decrease (%)		-8.07	5.11	16.25	3.59	15.65	10.61
6	Sesame	2004-10	177.73	68.14	389	310.87	113	368
		2011-15	128.31	61.77	475	182.37	84.23	462.11
	Increase/Decrease (%)		-27.81	-9.35	22.19	-41.34	-25.46	25.57
7	Pigeonpea	2004-10	4.67	4.51	966	264.24	261.53	988
		2011-15	3.28	3.52	1021	226.05	253.07	1119.78
	Increase/Decrease (%)		-29.76	-21.95	5.61	-14.45	-3.23	13.34
8	Wheat	2004-10	382.03	1325.43	3408	1027.27	2794.97	2693
		2011-15	295.09	1116.27	3599	1143.4	3339.71	2905.12
	Increase/Decrease (%)		-22.76	-15.78	5.63	11.30	19.49	7.88
9	Cumin	2004-10	125.24	73.7	582	222.59	118.97	534
		2011-15	170.16	130.77	727	325.33	227.08	696.33
	Increase/Decrease (%)		35.87	77.44	24.85	46.16	90.87	30.40
10	Onion	2004-10	49.06	1373.84	27770	53.4	1515.44	28128
		2011-15	51.02	1450.12	28445.03	54.04	1535.87	28436.76
	Increase/Decrease (%)		4.00	5.55	2.43	1.20	1.35	1.10
11	Garlic	2004-10	28.74	189.89	6515	30.54	203.79	6596
		2011-15	16.4	99.41	5892.59	18.37	111.02	5920.67
	Increase/Decrease (%)		-42.94	-47.65	-9.55	-39.85	-45.52	-10.24
12	Vegetables	2004-10	135.98	2402.51	17668	404.31	7054.48	17448
		2011-15	143.39	2736.79	18378	573.74	11378.01	19811
	Increase/Decrease (%)		5.45	13.91	4.02	41.91	61.29	13.54
13	Mango	2004-10	44.26	312.59	7062	139.42	973.98	6986
		2011-15	47.68	335.34	6793	144.67	1111.32	7665
	Increase/Decrease (%)		7.73	7.28	-3.81	3.77	14.10	9.72
14	Fruits	2004-10	76.37	868.78	11376	333.04	6087.38	18278
		2011-15	100.75	1205.32	14106	390.73	8231.04	21061
	Increase/Decrease (%)		31.92	38.74	24.00	17.32	35.21	15.23
15	Spices	2004-10	239.85	409.88	1709	486.88	834.44	1714
		2011-15	307.25	509.39	1926	534.57	1010.62	1884
	Increase/Decrease (%)		28.10	24.28	12.70	9.80	21.11	9.92
16	Flowers	2004-10	0.93	5.94	6328	10.71	80.56	7522
		2011-15	1.65	13.45	8313	17.78	162.03	9816
	Increase/Decrease (%)		77.42	126.43	31.37	66.01	101.13	30.50

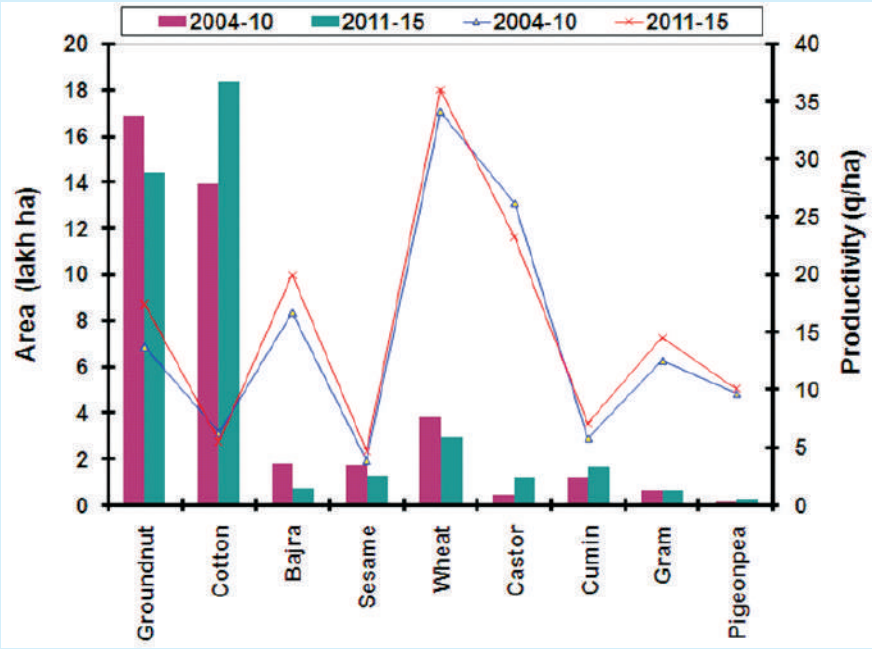


Figure 3: Comparative area and productivity of major crops in Saurashtra

Productivity gap can be defined as the difference between the yield achieved in the frontline demonstrations (FLDs) and the actual yield realized in Saurashtra region and Gujarat state between 2011-12 and 2015-16. The prevailing productivity gap of the major crops of Gujarat state and Saurashtra region is presented in Table 5. Except for bajra crop, the yield gap (%) in Saurashtra region was found to be lesser than that of Gujarat state in all the major crops. The yield gap variations in the Saurashtra region were higher in case of sesame (109 %) and castor (30 %), whereas lesser in gram (4 %) and cumin (2 %).

Table 5: Yield gap analysis of Saurashtra region and Gujarat state

Crop	Average Yield		FLD Avg. Yield	Saurashtra		Gujarat	
	Saurashtra	Gujarat		Actual (kg/ha)	% Actual / Avg. yield	Actual (kg/ha)	% Actual / Avg. yield
Groundnut	1743	1765	2231	488	28	466	26
Cotton	554	526	671	117	21	145	28
Castor	2322	2046	3022	700	30	976	48
Sesame	475	462	992	517	109	530	115
Wheat	3600	2905	4000	400	11	1095	38
Pigeonpea	1020	1120	1427	407	40	307	27
Gram	1455	1054	1511	56	4	457	43
Cumin	727	696	738	12	2	42	6
Bajra	1992	2062	2425	433	22	363	18

1.8 Animal Husbandry:

Animal Husbandry and Dairying play a vital role in the rural economy by generating substantial income to rural population where employment is scarce. As per the 2007 census, there is 237.94 lakh total livestock population in Gujarat State in which cattle, buffalo, sheep, goat and other livestock with population of 79.76, 87.74, 20.02, 46.40 and 4.03 lakh, respectively. Whereas in Saurashtra region total livestock population 63.56 lakh State in which cattle, buffalo, sheep, goat and other livestock with population of 23.22,19.26,10.23,10.23 and 0.62 lakh, respectively.. The sharing of cattle and sheep of Saurashtra region are higher in total livestock population of Gujarat. Saurashtra is the home of famous breed of cattle (Gir), buffalo (Jaffrabadi), goat (Zalawadi) and horse (Kathiawari).

1.9 Fisheries:

Gujarat has a long coastal-line of 1600 km, which comprises several bays, inlets, estuaries and marshy lands. It possess 1,64,000 sq. km of continental shelf area and more than 2,00,000 sq. km of EEZ offering a huge scope of coastal aquaculture. Though the state tops in marine fish production (7.09 lakh tonnes), it is ranked 15th in terms of inland fish production (1.01 lakh tonnes). Despite that, Gujarat is the third largest fish producer (8.10 lakh tonnes) in the country only behind Andhra Pradesh (19.64 lakh tonnes) and West Bengal (16.17 lakh tonnes). The area available for fishing activities extends from Lakhpat in Kachchh district in north to Umargaon in Valsad district in south. Important commercial varieties of fish namely pomfret, jew fish, Bombay duck, shrimp, lobster, squid, cuttle fish, silver bar, shark, catfish, mullets, etc. are caught in large quantities. In addition, the Gulf of Kachchh has congenial conditions for growth and sustenance of different type of oysters, shell fish and sea-weeds. Some important ports like Veraval, Porbandar, Pipavav, Okha and Sikka are located in Saurashtra region. The Saurashtra coast between the Gulf of Kutch and Gulf of Cambay presents unique oceanographic features endowed with a wide variety of highly relished table fishes.

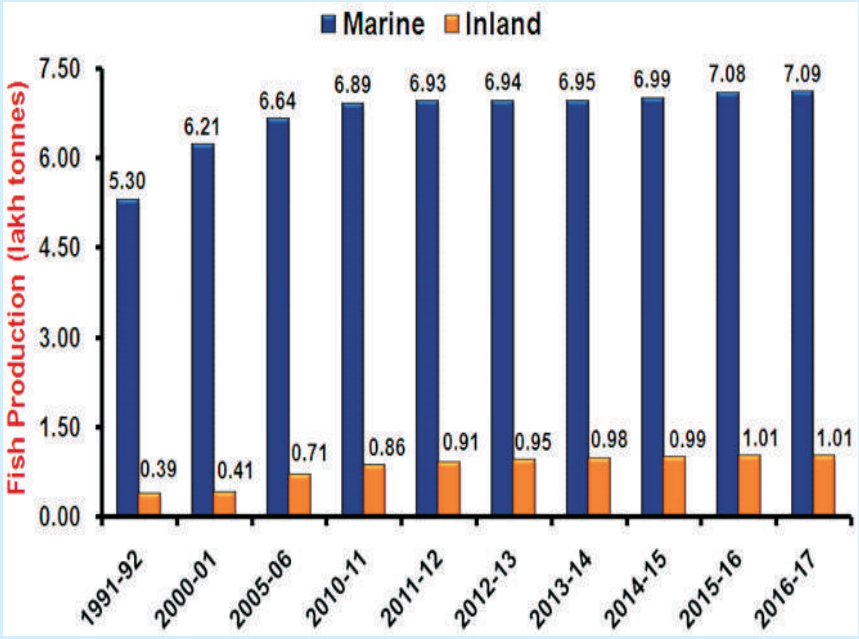


Figure 4: Marine and Inland Fish Production in Gujarat

More than 87 per cent of the total fish production in the state consists of marine fish production. As of 2014-15, Junagadh district occupied the largest share (40.79 %) in marine fish production with 2.84 lakh metric tonnes followed by Porbandar district with 0.93 lakh metric tonnes and 13.28 per cent share of marine fish production of the state. Altogether, the Saurashtra region alone comprised more than 72 per cent of total marine fish production of Gujarat state. In addition, during the period 2004-05 to 2014-15, the growth rate of marine fish production was found to be the highest in Porbandar district (5.80 %), followed by Jamnagar district (3.63 %) and Junagadh district (1.83 %) of Saurashtra region. It has been estimated that through the export of 2.82 lakh tonnes of fish and fish products in 2016-17, Gujarat generated an exchequer of more than Rs. 3000 crore in 2016-17.

1.10 Farmers' Income:

As the base year for doubling farmers' income is fixed to be 2016-17, it is vital to see the farmers' income for the same year in Gujarat and Saurashtra region. The findings furnished in Table 6 show that the average farmers' income in India to be around Rs. 99,474 per annum in 2016-17 but the median farmers' income was found to be only around Rs. 38,514 per annum. Similarly, in Gujarat though the average farmers' income was found to be Rs. 1.23 lakh per annum, whereas the median farmers' income turned out to be Rs. 28,251 per annum alone. The median income in

Saurashtra region was found to be slightly better than Gujarat state as well as the all India figures. As figure 5 suggests, farmers' average income per annum was found to be the third highest in Saurashtra only preceded by Kutch and North Gujarat regions. It is to be noted that inclusive growth has to be taken in to consideration while devising strategies for doubling or enhancing farmers' incomes. Otherwise, the nation's 80 per cent small and marginal farmers would be totally left out. Henceforth, more than average income of farmers, the median income (i.e. the middle-most income) is the one that needs to be doubled.

Table 6: Farmer's income in Gujarat and India (2016-17) / annum*

Particular	Income sources				Average income (Rs.)	Median income (Rs.)
	Farming (Rs.)	Livestock (Rs.)	Business (Rs.)	Wages (Rs.)		
Saurashtra	43,110	32,010	1882	22,100	99,104	41,866
Gujarat	45,403	29,876	5,882	41,533	1,22,694	38,514
India	47,694	11,811	7,926	32,059	99,474	28,251

***Nominal income of 2012-13 of NSSO is multiplied with CPIAL index of 1.29 (RBI)**

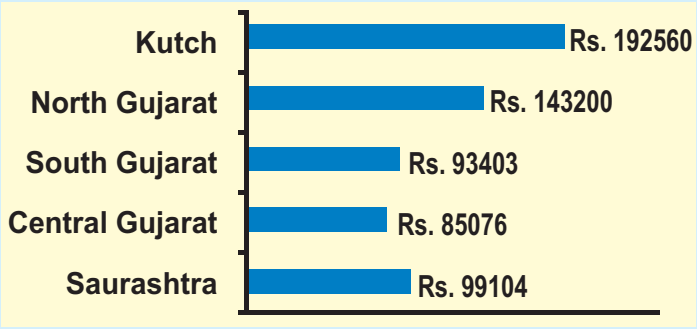


Figure 5: Region-wise annual farmer's income in Gujarat (2016-17)

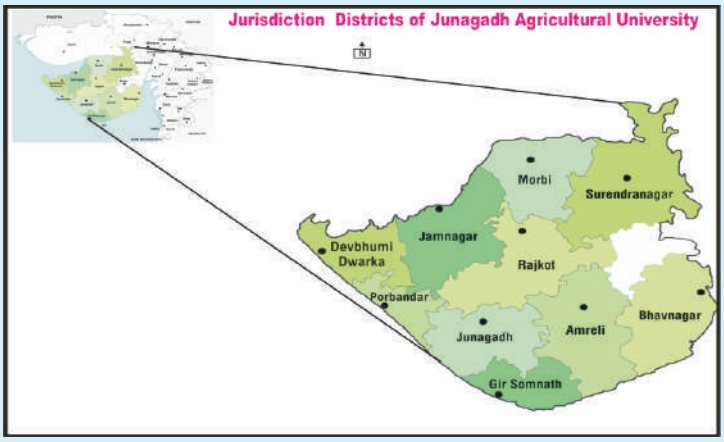
❐

2.0 JAU Profile

The agricultural education in Saurashtra region of Gujarat State started way back in 1960 with the establishment of College of Agriculture in a palatial building at Sardarbaug, Junagadh. The college was affiliated to Gujarat University, Ahmedabad from its outset till the year 1967.

Subsequently, the affiliation of the College of Agriculture was transferred to Saurashtra University, Rajkot during the year 1968. Meanwhile, Gujarat Agricultural University (GAU) was established as an autonomous body in 1972. The affiliation of the college was then transferred to the newly established Gujarat Agricultural University along with all the activities so far carried out by the Department of Agriculture. Thereby, it became a constituent college of the Gujarat Agricultural University and was working under its aegis till 2004.

Junagadh Agricultural University was carved out of Gujarat Agricultural University along with the three other SAU's in Gujarat and it came in to existence on May 01, 2004 by Act No. 5 of the Government of Gujarat. The jurisdiction of this University comprises ten districts viz. Junagadh, Rajkot, Jamnagar, Porbandar, Amreli, Bhavnagar, Surendranagar, Gir Somnath, Morbi and Devbhoomi Dwarka of Saurashtra region covering 32.82 per cent (6.43 million ha) area of Gujarat (19.68 million ha).



Jurisdiction map of JAU, Junagadh

While considering the major soil types, rainfall and temperature pattern, the Gujarat State is divided into eight agro-climatic zones *viz.* I- South Gujarat Heavy Rainfall, II- South Gujarat, III- Middle Gujarat, IV- North Gujarat, V- North West, VI- North Saurashtra, VII- South Saurashtra and VIII- Bhal & Coastal area. Out of which, the Junagadh Agricultural University is functioning in agro-climatic zone No. VI, VII and part of zone V & VIII.Gujarat Agricultural Universities Act 2004 vested powers with Junagadh Agricultural University (JAU) to institute degrees, diplomas and other academic distinctions. Accordingly, JAU has powers to provide instruction in Agriculture and allied sciences and in such other branches of learning as the University may deem fit. The University has been authorized to establish and maintain colleges relating to Agriculture, Horticulture, Agricultural Engineering & Technology, Fisheries Science, Veterinary Science & Animal Husbandry and Agri-Business Management and, institute courses of study and hold examination leading to the conferring degrees, diplomas and other academic distinctions on persons who pursue a course of study and/or carry out research in the University or in an institution recognized in this behalf by the University. The University is empowered to award fellowships, scholarships, medals, prizes, besides conferring honorary degrees or other distinctions. The University is also authorized to make provision for research and dissemination of the findings of research and technical information through extension education programmes. Keeping in view, the wider objective of taking agricultural education to farming community in the state, University has made provision to provide lectures and instructions for field workers, village leaders and other persons not enrolled as regular students of the University and to grant certificates to them. Board of Management, Academic Council and Board of Studies which are statutory authorities of the University, oversee the educational programmes of the University. The organisational chart of the University is presented in figure 6.

2.1 Education:

In 2004, the erstwhile GAU was bifurcated into four Agricultural Universities *viz.*, Anand Agricultural University, Navsari Agricultural University, Sardarkrushinagar Dantiwada Agricultural University and Junagadh Agricultural University. The institutions and research stations of JAU, Junagadh located in ten districts (Saurashtra region) of the State came under the jurisdiction of JAU. The growth of the University over the years has been phenomenal. To begin with, the University had five UG degree programmes covering broadly Agriculture, Horticulture, Agricultural Engineering, Veterinary Science and Fisheries Science. Over the years, attempts have been made to diversify agricultural education by

starting specialized under graduate and post graduate degree programmes in various branches of agricultural sciences. The education programme in Junagadh Agricultural University is based on two tier system. The first one covers higher education in Agriculture, Horticulture, Agricultural Engineering, Fisheries Science and Veterinary Science & Animal Husbandry, in which UG and PG resident instruction programmes are covered. While the second consists of lower education, i.e., Polytechnic Diploma and Certificate programmes like Agro-ITI, Bakery Training, Input dealers course, Mali Training as well as Extension Education Training.

Presently the University offers five Bachelors' degree programmes covering Agriculture, Horticulture, Agricultural Engineering, Fisheries Science and Veterinary Science & Animal Husbandry and six Masters' degree programmes in 37 disciplines of Agriculture and Horticulture (Agril. Economics, Agril. Extension, Agril. Entomology, Agril. Meteorology, Agronomy, Crop Physiology, Plant Breeding & Genetics, Vegetable Science, Fruit Science, Plant Pathology, Seed Science & Technology, Soil Science & Agril. Chemistry, Plant Molecular Biology and Biotechnology, Floriculture & Landscaping, Agril. Biochemistry, Agril. Statistics), Agril. Engineering & Technology(Processing and Food Engineering, Farm Machinery & Power, Soil & Water Engg., Renewable Energy Engineering), Fisheries Science (Fisheries Resources Management, Fish Processing Technology, Aquaculture), Veterinary Science & Animal Husbandry (Animal Genetics & Breeding, Animal Nutrition, Livestock Production & Management, Veterinary Surgery & Radiology, Veterinary Microbiology, Veterinary Pharmacology & Toxicology, Veterinary Gynaecology&Obstetrics, Veterinary Clinical Medicine, Veterinary Parasitology, Veterinary Pathology, Veterinary Public Health, Livestock Production Technology and Veterinary Biochemistry) and Agri-business Management and Doctoral degree programmes in various disciplines.

Academic achievements :

- The University and its five constituent colleges viz. College of Agriculture, College of Agril. Engg. & Tech., College of Fisheries Science, College of Veterinary Sci. & A.H. and PG Institute of ABM have been accredited for five years from 28th March, 2016 by ICAR, New Delhi.
- The University offers five Bachelors' degree programmes, six Masters' degree programmes in 37 disciplines, six Doctoral degree programmes in 33 disciplines and eight Polytechnic programmes.

- The University hasbegun three years Polytechnic Diploma programmes in Agriculture, Horticulture, Agro-Processing, Animal Husbandry and Agril. Engineering for upliftment of rural youth with provision of Diploma to Degree programme except Animal Husbandry.
- The University has implemented online exam management system through JEMS for Polytechnic, UG and PG programmes.
- The University linkage with the National Information System on Agricultural Education Network in India (NISAGNET) for upload of data.
- The University joined with National Academic Depository (NAD) for online store house of all academic awards under the flagship programme i.e. Digital India.
- The University library possesses around 53,500 books, 60 Indian& 17 foreign journals and around 16,000 back volumes. The cybrary with LAN connectivity to access online database like J-Gateplus and CAB ABSTRACTS and also through CeRA, KRISHIKOSH, CD-ROM database like CAB, AGRICOLA and AGRIS for students and faculties.
- The University provides Wi-Fi facility at various colleges, departments, hostels and University canteen.
- There are twelve Experiential Learning Programmes (ELPs) functioning for self-practical work for last year UG students in the University.
- Accommodation facility is available for all admitted students including foreign students along with healthy food canteen at each hostel of boys and girls.
- There is no fee for girls of Polytechnic, UG and PG courses.
- Placement Cell is available and more than 50% passed out students obtain job in government and non-government sectors, while others opt for higher studies.
- Indoor and outdoor sports facilities are available for various games and the University organises games at University, State and National levelsfor students.
- Anti-ragging, SC/ST and Gender Cells exist in the University to control nuisance.
- Health Centre along with ambulance facility is available for students and faculty.

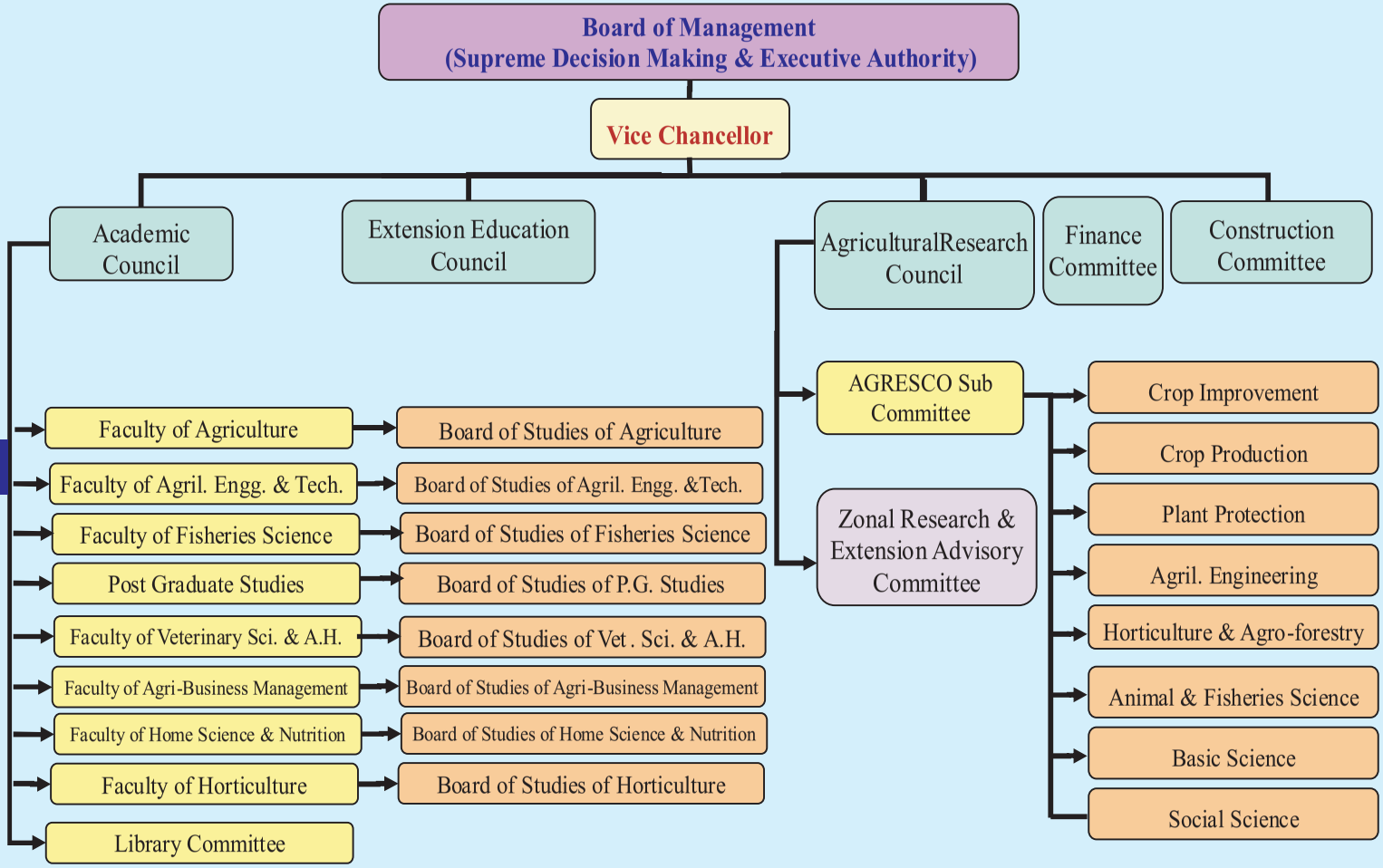


Figure 6 : Organizational chart of Junagadh Agricultural University

Table 7: Undergraduate, Post Graduate and Polytechnic Diploma Programmes offered by the University

College	Duration (years)	Started during year
1. College of Agriculture, Junagadh		
B.Sc. (Hons.) (Agri.)	4	1960
M.Sc. (Agri.)	2	1965
M.Sc. (Hort.)	2	2010
Ph.D.(Agri.)	3	1965
Ph.D.(Hort.)	3	2010
2. College of Agriculture, Mota Bhandariya (Amreli)		
B.Sc. (Hons.) (Agri.)	4	2014
3. College of Agriculture, Khapat (Porbandar)		
B.Sc. (Hons.) (Agri.)	4	2017
4. College of Agril. Engg. & Tech., Junagadh		
B.Tech. (Agril. Engg.)	4	1984
M.Tech. (Agril. Engg.)	2	1994
Ph.D.	3	2001
5. College of Fisheries Science, Veraval		
B.F.Sc.	4	1991
M.F.Sc.	2	2006
Ph.D.	3	2011
6. College of Veterinary Science & A.H., Junagadh		
B.V.Sc. & A.H.	5	2008
M.V.Sc.	2	2007
Ph.D.	3	2007
7. College of Horticulture, Junagadh		
B. Sc. (Hons.) (Hort.)	4	2012
8. PG Institute of Agri-Business Management, Junagadh		
MBA in Agri-Business	2	2008
9. Polytechnic in Agriculture, Dhari		
Diploma in Agriculture	3	2009
10. Polytechnic in Horticulture, Junagadh		
Diploma in Horticulture	3	2009
11. Polytechnic in Agro-processing, Junagadh		
Diploma in Agro-processing	3	2009
12. Polytechnic in Home Science, Amreli		
Diploma in Home Science	3	2009
13. Polytechnic in Agriculture, Halvad		
Diploma in Agriculture	3	2018
14. Polytechnic in Agriculture, Sidsar		
Diploma in Agriculture	3	2018
15. Polytechnic in Agril. Engineering, Targhadia		
Diploma in Agril. Engineering	3	2014
16. Polytechnic in Animal Husbandry, Junagadh		
Diploma in Animal Husbandry	3	2014

The University has a well-established library, 22 hostel blocks for boys and 6 for girls having capacity of about 2504 students and adequately developed sports complex which is one of the best play ground and sports complex in Saurashtra. A large number of graduates and post graduates from College of Agriculture, College of Horticulture, College of Agricultural Engineering & Technology, College of Veterinary Science & Animal Husbandry and College of Fisheries Science have occupied senior positions in different departments such as Agriculture, Horticulture, Fisheries, Forest, Police, Custom, Institutions, Corporate, Civil Services, Banking Services, Pesticides, Fertilizers and Seed Industries, etc. Some of the alumni of this University also reached to the rank of Vice Chancellor and Director of Campus of Gujarat Agricultural University, Director of Agriculture, Minister of Agriculture in the State of Gujarat. They made significant contributions in upliftment of agriculture.

During the period of year 2013-14 to 2017-18, 931 students at polytechnic diploma level, 1921 students at UG level and 1214 students at PG (Master and Doctoral) level were admitted in various colleges of the University i.e. College of Agriculture, College of Horticulture, College of Agricultural Engineering & Technology, College of Veterinary Science & Animal Husbandry and PG Institute of Agri-Business Management and College of Fisheries Science. During the period (2013-14 to 2017-18) 1462 students at UG level and 941 at PG (Master and Doctoral) level have successfully completed their degree courses.

Table 8: Details of Undergraduate students

Degree	Particular	13-14	14-15	15-16	16-17	17-18	Total
B.Sc. (Hons.) (Agri.), Junagadh	Intake	139	139	139	139	123	679
	Admitted	122	118	116	122	115	593
	Pass out	94	115	133	126	124	592
B.Sc. (Hons.) (Agri.), Mota Bhandariya	Intake	30	30	30	51	51	192
	Admitted	25	23	25	45	45	163
	Pass out	0	0	0	25	18	43
B.Sc. (Hons.) (Agri.), Khapat	Intake	0	0	0	30	30	60
	Admitted	0	0	0	22	24	46
	Pass out	0	0	0	0	0	0
B.Sc. (Hons.) (Hort.)	Intake	50	50	50	51	51	252
	Admitted	41	35	46	44	43	209
	Pass out	0	0	36	47	35	118
B.Tech. (Ag. Engg.) Junagadh	Intake	97	97	97	97	87	475
	Admitted	92	81	89	93	85	440
	Pass out	73	75	100	104	94	446
B.F.Sc. Veraval	Intake	77	77	77	77	68	376
	Admitted	53	38	50	38	61	240
	Pass out	16	19	46	48	35	164

Degree	Particular	13-14	14-15	15-16	16-17	17-18	Total
B.V.Sc. & A.H Junagadh	Intake	40	40	60	60	60	260
	Admitted	30	38	56	49	57	230
	Pass out	0	18	27	31	23	99
UG total	**Intake**	**433**	**433**	**453**	**505**	**470**	**2294**
	Admitted	**363**	**333**	**382**	**413**	**430**	**1921**
	Pass out	**183**	**227**	**342**	**381**	**329**	**1462**

Table 9: Details of Post Graduate (Masters' Degree) students

Degree	Particular	13-14	14-15	15-16	16-17	17-18	Total
M.Sc. (Agri.)	Intake	116	124	148	159	146	693
	Admitted	68	82	96	137	136	519
	Pass out	85	60	48	93	136	422
M.Sc. (Hort.)	Intake	15	18	22	26	21	102
	Admitted	12	16	20	22	20	90
	Pass out	17	11	9	23	20	80
M.Tech. (Ag. Engg.)	Intake	28	31	31	27	30	147
	Admitted	21	24	16	27	30	118
	Pass out	15	18	19	20	13	85
M.F.Sc.	Intake	25	24	19	17	16	101
	Admitted	7	10	6	15	13	51
	Pass out	22	2	7	7	6	44
M.V.Sc.	Intake	36	36	36	32	31	171
	Admitted	4	16	8	20	15	63
	Pass out	3	1	8	12	11	35
MBA in Agri business	Intake	43	43	43	43	35	207
	Admitted	32	39	38	41	34	184
	Pass out	20	16	27	34	52	149
Total Master Degree	**Intake**	**263**	**276**	**299**	**304**	**279**	**1421**
	Admitted	**144**	**187**	**184**	**262**	**248**	**1025**
	Pass out	**162**	**108**	**118**	**189**	**238**	**815**

Table 10: Details of Ph.D. students

Degree	Particular	13-14	14-15	15-16	16-17	17-18	Total
Ph.D. (Agri.)	Intake	33	38	48	40	36	**195**
	Admitted	18	26	20	26	28	**118**
	Pass out	5	17	16	25	30	**93**
Ph.D. (Hort.)	Intake	5	7	8	6	5	**31**
	Admitted	4	6	6	4	4	**24**
	Pass out	1	3	0	1	2	**7**
Ph.D. (Ag. Engg.)	Intake	8	13	11	11	13	**56**
	Admitted	2	5	1	4	4	**16**
	Pass out	0	0	1	5	3	**9**
Ph.D. (Fish.)	Intake	10	6	8	9	10	**43**
	Admitted	2	2	5	5	0	**14**
	Pass out	1	0	5	3	1	**10**
Ph.D. (Vet. Sci.)	Intake	12	12	10	8	4	**46**
	Admitted	0	2	6	2	2	**12**
	Pass out	0	0	1	0	6	**7**
Ph.D. (ABM)	Intake	0	0	2	5	3	**10**
	Admitted	0	0	1	2	2	**5**
	Pass out	0	0	0	0	0	**0**
Total Ph.D. Degree	Intake	**68**	**76**	**87**	**79**	**71**	**381**
	Admitted	**26**	**41**	**39**	**43**	**40**	**189**
	Pass out	**7**	**20**	**23**	**34**	**42**	**126**

Table 11: Details of Polytechnic courses

Degree	Particular	13-14	14-15	15-16	16-17	17-18	Total
Polytechnic Diploma	Intake	210	210	210	210	210	**1050**
	Admitted	182	178	205	191	175	**931**
	Pass out	112	107	140	135	131	**625**

2.2 Research:

The University has taken up the task to intensify and reorganize the research, education and extension education. Junagadh Agricultural University has 31 research stations including multidisciplinary main research stations, sub centres on various crops and testing centres spread over in whole North Saurashtra & South Saurashtra Agro-climatic Zones and part of North-West & Bhal-Coastal Area Agro-climatic Zones of Gujarat. These research stations are working in the field of Agriculture, Horticulture, Agricultural Engineering, Animal Sciences and Fisheries for catering the needs of farmers, artisans, livestock holders, fishermen and rural masses for their upliftment. The research activities have been carried out in Crop Improvement, Crop Production, Horticulture and Agroforestry, Plant Protection, Basic Sciences, Social Sciences, Agricultural Engineering, Animal Science and Fisheries Science.

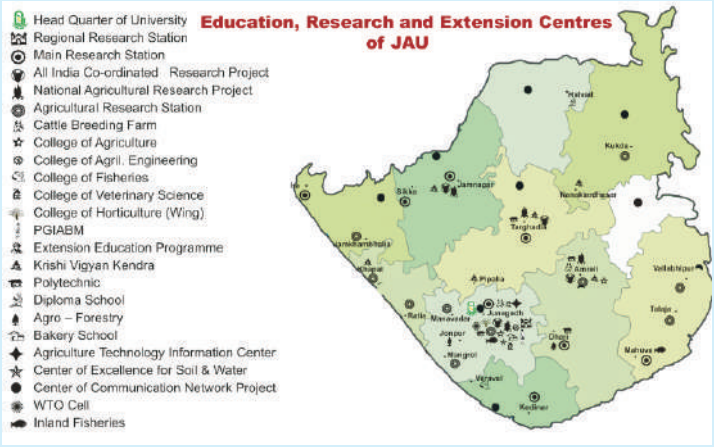


Table 12: Research Stations under JAU

SN	Location	Category of station	Land (ha)			Mandate
			Total	Cultivated	Irrigated	
1	Junagadh: 1. Oilseeds 2. Wheat 3. Cotton 4. Pulse 5. Castor 6. Vegetable 7. CERS 8. Agril. Engg. 9. CBF 10.Inland fisheries	Main, Regional & Zonal	375.54	332.98	253.53	**Crops**: Groundnut, Castor, Cotton, Wheat, Pulses, **Fruit Crops**: Mango, Sapota, Banana, Papaya, pomegranate, custard apple *etc*. **Vegetables**: Brinjal, Tomato, Okra, Bottle gourd, Sponge gourd, Ridge gourd, Cauliflower, Chilli *etc*. **Seed spices:** Onion, Garlic, Cumin, Fenugreek, Coriander **Flower crops** **Veterinary**: Animal breeding and livestock production in Gir Cow and Jaffrabadi buffalo, **Inland fisheries cultivation**
2	Targhadia	Main	24.39	17.96	02.00	Soil & water conservation and production practices in rainfed crops.
3	Jamnagar	Main	36.41	25.06	11.00	Development of variety and production technology in pearl millet
4	Kodinar	Regional	57.42	40.61	31.36	Development of production technology in sugarcane
5	Amreli	Regional	23.25	17.25	07.00	Development of variety and production technology in sesame, Soybean and sunflower
6	Dhari (Three Unit)	Regional	652.85	76.87	26.53	Research on forage and rainfed crops
7	Mahuva: 1. ARS (Fruit) 2. Fisheries	 Regional Sub	 431.00 50.00	 60.00 48.00	 25.00 -	Development of variety and production technology in plantation and horticultural crops Research on aquaculture
8	Mangrol	Sub	16.19	15.55	15.55	Development of nursery and production technology in plantation and fruit crops
9	Manavadar	Sub	41.53	32.99	09.00	Seed production and production technology in oilseeds crops

Table 12: Contd.

SN	Location	Category of station	Land (ha)			Mandate
			Total	Cultivated	Irrigated	
10	Khapat	Sub	03.73	02.23	02.23	Seed production and production technology in cotton & other crops
11	Ratiya	Sub	36.81	33.96	01.20	Seed production and production technology in *Deshi* cotton, Sorghum, Gram in conserve moisture.
12	Jam Khambhalia	Sub	23.47	18.55	02.00	Seed production and production technology in rainfed crops
13	Vallabhipur	Sub	24.94	20.00	-	Seed production and production technology in rainfed crops
14	Halavad	Sub	19.04	14.41	10.56	Seed production in desi cotton and other crops
15	Okha	Sub	0.8	-	-	Development of fisheries technology.
16	Sikka	Sub	11.20	-	-	Development of fisheries technology.
17	Kukada	Sub	42.05	37.58	-	Development of production technology in cotton (*Deshi,* Hybrid and Bt. cotton)
18	Talaja	Sub	54.65	42.25	05.00	Seed production and production technology in onion, sugarcane & pearl millet
19	Amreli	Sub	10.00	04.65	03.65	Bull mother of *Gir* Cow &*Jaffrabadi* buffalo.
20	Jonpur	Sub	130.11	-	-	Production of grass
21	CoA, Junagadh	Department (On campus)	204.65	167.68	109.88	UG/PG education and research, natural resource management, organic farming, integrated farming system, horticultural crops, plant protection, biocontrol and weed control, MIS system, Biotechnology, Biopesticides, Food testing, Meteorology and Protected cultivation. *etc.*

Table 12: Contd.

SN	Location	Category of station	Land (ha)			Mandate
			Total	Cultivated	Irrigated	
22	CAET, Junagadh	Department (On campus)	28.07	25.00	25.00	UG/PG education and research, soil & water conservation, farm power & machinery, renewable energy, post-harvest technology and agro-processing.
23	CoVSc & AH, Junagadh	Department (On campus)	28.70	-	-	UG/PG education- laboratory and field practical work
24	CoA, Amreli	(Off campus)	33.00	31.00	-	UG education-laboratory and field practical work
25	CoFSc, Veraval	(Off campus)	8.45	-	-	UG/PG education- laboratory and field practical work
26	KVKs:	District level				Dissemination of research technology through extension programmes.
	Khapat		20.25	17.80	17.80	
	Jamnagar		20.84	14.05	11.65	
	Targhadia		20.00	18.00	01.00	
	Nana Kandhasar		26.70	20.94	02.77	
	Amreli		19.31	18.00	03.00	
	Pipaliya		20.00	20.00	04.00	
	Gor Khijadia		26.20	06.00	05.00	
27	Junagadh	Campus area	148.19	-	-	Infrastructure
		Total	**2667.04**	**1179.47**	**585.71**	

The various research projects, their monitoring and supervision, planning and implementation of research activities at different research stations as well as the PG teaching programmes and their evaluation in different disciplines were carried out under the guidance of Director of Research & Dean PG. The efforts made by scientists of the University were emerged in 193 technologies including varieties for farmers during year 2013-14 to 2017-18. The University has also developed 24 crop varieties (22 new varieties + 2 varieties area expansion) for farmers, out of which eight varieties were released at state and national level.

Outstanding achievements in varietal development:

- Groundnut variety GJG 22 is developed as an alternative ofmost popular cultivated variety GG 20 in Gujarat.
- Wheat variety GW 496 is most popular high yielding and most preferable by consumers.

- Wheat variety GW 366 is developed for high yield and grain quality and became popular in Madhya Pradesh, Maharashtra and Rajasthan states.
- Wheat variety GJW 463 is developed for drought and salinity tolerance and micronutrient fortified.
- Gram GG 3 variety is high yielding and resistant against wilt diseases which is most suitable for *Daliya.*
- Sesame varieties i.e. G.Til 2, G.Til 3 and GJ Til 5 are developed for summer season cultivation.
- The university has developed seven bajra hybrids of which GHB 558 is most suitable for *kharif*, summer and semi *rabi* seasons and registered most popular in country, particularly in the states of Punjab, Haryana and Rajasthan.
- Ridge gourd, GJRGH 1and Papaya GJP 1 variety are developed first for cultivation in Gujarat.
- Coconut hybrid D x T is developed and one mega elite seed plot is established to provide sufficient seedling to the farmers.
- Identified genotypes DRT-2004-7 and J-53 of groundnut possessed drought tolerance.
- Identified JAUP1 to JAUP4 series of primers for sex determination at pre-flowering stage in '*Madhubindu*' variety of papaya.
- Identified JAUC1 to JAUC5 series of primers to identify *Fusarium* wilt resistant genotypes of castor in MAS or MAB, besides identified JAUC6 to JAUC10 series of primers to identify root rot resistant genotypes in castor.
- During 2007-14, JAU was found leading with a share of 4 per cent in PPV& FRA applications among the SAU's in India.

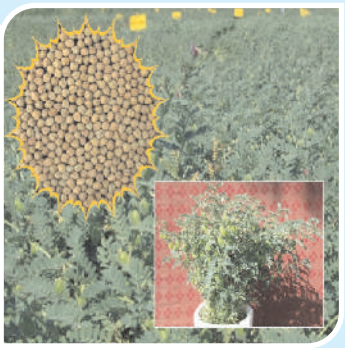
Table 13: Crop Varieties Released

Sr. No.	Year	Crop	Variety	Level of release
1	2013-14	Chickpea	GG-5	State & National
		Pegion pea	GJP-1	State
		Garlic	GJG-5	State
2	2014-15	Groundnut	GJG-18 *	National
			GJG-19 *	National
		Sesame	GJT-5	State
		Chickpea	GJG-6	State
		Pigeon pea	GJP-1 (Area Expan)	State
		Brinjal	GJLB-4	State & National
			GJBH-4	State
		Okra	GJOH-4	State & National
		Onion	GJRO-11	State
		Sponge gourd	GSG-2	State
3	2015-16	Wheat	GJW-463	State
		Onion	GJRO-11 (Area Expan)	State
			GJWO-3	State
4	2016-17	Groundnut	GJG-32	State & National
			GJG-33 *	National
		Castor	GCH-9	State
		Papaya	GJP-1	State
5	2017-18	Groundnut	GG HPS-2	State
		Sesame	GT-6	State
		Cotton	GJ.Cot-102 (Endorse)	State & National
			G.Cot.Hy-22	State
		Brinjal	GRB-5	State
		Tomato	GT-6	State
		Okra	GO-6	State

***Varieties released at national level (others states)**

GJG-32

GJBH-4



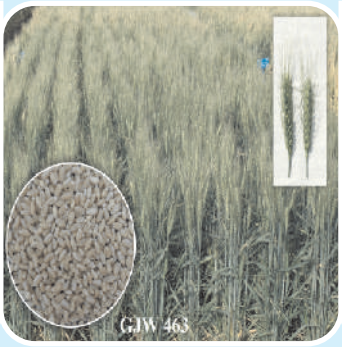
GJG-6

GJP-1

G.Til-6

GT-6

Coconut D x T



GJW-463

GHB-905

For transfer of developed technologies among farmers, research centre also takes Front Line Demonstrations on farmer's field. Total 1135 FLDs were taken during last five years. Besides this, seed production programme was also taken up in different crops and varieties. About 14,209 q breeder and 31,866 q truthful seeds were produced during 2013-14 to 2017-18 under Mega Seed Project. During this span, total 2,00,188 graft of fruit crops, 1,63,794 plant sapling, 3,83,913 seedlings and 1,18,109 ornamental & medicinal plants were availed to the farmers.

Development of innovative research technologies:

- Mass production of bio-agents and biofertilizers for farmers.
- Refrigerator storage technique of Nuclear Polyhedrosis Virus (NPV) for biological control of Helicoverpa armigera and Spodoptera litura.
- Integrated Farming System Model Farm for small and marginal farmers.
- Power operated sapota cleaner for cleaning and shining sapota surface after harvesting.
- Pheromone based mating disruption technology for pink bollworm in cotton.

- Organic input production units like vermicompost, NADEP compost, etc.
- Low cost greenhouse fertigation system in vegetables.
- White colour 50 per cent shade net house for cultivation of capsicum as compared to green, black and blue colour shade net house.
- Breeding improvement of pride breeds i.e. *Gir* Cow and *Jaffrabadi* Buffalo of Saurashtra through sufficient amount of semen production and availed to Gaushalas, Panjarapols, NGOs and veterinary clinics for Artificial Insemination.
- Potassium bio sensor for requirement of potassium in standing crop.
- NPK nano-fertilizers.

The University produces and distributes bio-agent Trichoderma harzianum for the management of various soils borne disease especially stem and pod rot of groundnut in the Saurashtra region. Similarly, liquid biofertilizers like *Rhizobium* and *Azotobacter* and Phosphate Solubilizing Bacteria are being produced in the University for farmers, State Departments, other Govt. bodies etc. at reasonable price. The university has also produced various microbial agents e.g. viruses, bacteria, fungi, protozoans and nematodes which are being used in IPM program. Among viral pathogens, nuclear polyhedrosis viruses of Helicoverpa (HNPV), Spodoptera (SNPV), entomopathogenic fungi *Beauveria bassiana*, Trichocard, fruit fly trap, fruit fly lure, pheromone trap, pheromone lure are widely used for insect control. These pathogens are highly specific to their host and being considered environmentally safe. During last five years (2013-14 to 2017-18), the university has produced and distributed sufficient quantity of bioagent, biofertilizer and biocontrol appliances with Sawaj brand to the farmers (Table 17). Gir cow and Jaffarabadi buffalo are pride of Saurashtra. Under breed improvement programme, semen doses collected from pure breed of Gir and Jaffarabadi bull and distributed to Gaushala, Grampanchayat and animal hospitals for Artificial Insemination. The university also provided pure bull of Gir (235) and Jaffrabadi breed (122) to Gram Panchayat and Gaushala under government scheme. During this span, the university has distributed semen doses of Gir (35,018) and Jaffarabadi bull (68,674) out of their collected semen doses (1,63,666 and 1,40,980) for AI, respectively.

Infrastructure development for research:

- High tech museum for seed production technologies
- Well established biocontrol lab and bioagent production unit for large scale production.
- NABL accredited Food testing laboratory for analysis of chemical residue,

biochemical parameters and element composition.

- Farm equipment and machinery testing lab for validation of equipment/machinery developed by manufacturer.
- Clinical complex for diagnosis and operation services of domestic and wild animal for 24 hours.
- Agro processing lab for value addition of economical produce
- Soil testing lab at campus and at all KVKs for analysis of soil samples of farmers
- Fish hatchery lab for research and production of fish nymph
- Accredited horticultural nurseries for large scale production of graft, seedling and other planting material
- Animal breeding lab for research and production of semen doses for AI in Gir cow and Jaffarabadi buffalos

Under HRD component of the University (Table 19), there were a total of 3250 participations in different programmes like seminar, conference, workshop, group meet etc. The university has also organised 40 programmes. The University maintains a strong rapport with the line departments of the State. The cooperation between the University and these departments spans the areas of identification of problems to find the solutions. A strong and similar association exists between the various research agencies. The University thus has collaborative research in association with almost all the Central Institutes allied to agriculture, fisheries, veterinary sciences, agricultural engineering and the related fields. Similar collaborative work exists between the State Research Institutes and the University. For strengthening of the research, the university has developed 96 linkages and signed 21 MoUs with state, national and international organization for education, research and extension activities in last five years. During 2013-14 to 2017-18, total 145 new research projects were sanctioned by ICAR, Government of India, Government of Gujarat and other agencies. The University has registered 19 varieties in PPV & FR, Gir Kesar mango is registered as Geographical Indication No.185 by GI Registration, Government of India, Chennai for Gir region of Junagadh, Gir Somnath & Amreli.

Table 14: Recommendations / Technologies Developed

Sub-Committee	Number of recommendations for farmers					
	2013-14	2014-15	2015-16	2016-17	2017-18	Total
Crop Improvement	3*	8*	3*	3*	7*	**24***
Crop Production	15	13	10	13	15	**66**
Plant Protection	6	16	3	4	12	**41**
Horticulture & Agroforestry	2	4	2	6	2	**16**
Agricultural Engineering	8	5	4	8	10	**35**
Animal Science	2	-	-	1	3	**06**
Fisheries Science	4	3	2	5	3	**17**
Basic Science	2	4	3	2	1	**13**
Total	**3*+39**	**8* + 45**	**3* + 24**	**3*+ 39**	**7* + 46**	**24*+193**

Note: * No. of varieties released

Table 15: No. of Front Line Demonstrations (FLDs) conducted on farmers' field

SN	Crop	2013-14	2014-15	2015-16	2016-17	2017-18	Total
1	Groundnut	30	45	11	12	19	117
2	Castor	15	20	-	-	30	65
3	Pearl millet	88	95	108	175	87	553
4	Cotton	40	50	-	-	-	90
5	Wheat	32	10	10	10	42	104
6	Chickpea	48	10	-	-	-	58
7	Sesame	15	20	-	20	-	55
8	Vegetables & Spices	14	16	19	23	21	93
Total		**282**	**266**	**148**	**240**	**199**	**1135**

Table 16:Production of quality seeds/planting materials of different crops.

Particular	2013-14	2014-15	2015-16	2016-17	2017-18	Total
Breeder / Nucleus seeds (q)	2420	2822	2562	3099	3306	**14209**
Truthful/ Foundation/ Certified seeds (q)	8150	6284	4665	7087	5680	**31866**
Total	**10570**	**9106**	**7227**	**10186**	**8986**	**46075**
Fruit crops graft (Nos.)	125121	16959	9974	25149	22985	**200188**
Fruit crops saplings (Nos.)	19151	83412	19407	14861	26963	**163794**
Seedlings (Nos.)	4760	23110	75567	64662	47635	**383913**
Ornamentals & Medicinal plants (Nos.)	-	-	32441	43987	41681	**118109**
Total	**149032**	**123481**	**137389**	**148659**	**139264**	**697825**

Table 17: Production of SAWAJ brand bio-agent, microbial agent, liquid bio-fertilizer *etc.*

SN	Name of Product	2013-14	2014-15	2015-16	2016-17	2017-18	Total
1	*Trichoderma* (tonne)	53	37	58	105	179	**432**
2	*Rhizobium* (litres)	378	5849	1260	1628	2712	**11827**
3	*Azotobacter* (litres)	1778	991	1429	1496	2082	**7776**
4	PSB (litres)	1023	994	2276	2451	3283	**10027**
5	*Beauveria* (tonne)	2	6	37	145	176	**366**
6	HNPV(litres)	6	41	43	172	287	**549**
7	SNPV (litres)	22	36	40	99	117	**314**
8	Trichocard (Nos.)	570	800	1802	450	2382	**6004**
9	Fruit fly Traps (Nos.)	-	297	1913	1574	2474	**6258**
10	Fruit Fly lure (Nos.)	-	350	2632	1952	3300	**8234**
11	Pheromone Trap (Nos.)	-	-	-	124804	60679	**185483**
12	Pheromone lure (Pink Bollworm &Spodoptera) (Nos.)	-	-	-	151249	163843	**315092**

Table 18: Production and distribution of semen doses of Jaffrabadi and Gir Bulls

Particular	2013-14	2014-15	2015-16	2016-17	2017-18	Total
No. of frozen semen doses produced from Gir Bulls	11321	10097	45511	67037	29700	**163666**
No. of frozen semen doses produced from Jaffrabadi Bulls	18704	10970	44836	44105	22365	**140980**
No. of semen doses of Gir Bulls used for AI	5777	4686	5510	8040	11005	**35018**
No. of semen doses of Jaffrabadi Bulls used for AI	8630	9361	6230	7643	36810	**68674**
No. of Gir Bulls distributed to Gram Panchayat Gaushala *etc.*	51	24	22	88	50	**235**
No. of Jaffrabadi Bulls distributed to Gram Panchayat Gaushala, *etc.*	10	12	31	58	11	**122**

Table 19: Human Resource Development (HRD)

Sr. No.	Particulars	2013-14	2014-15	2015-16	2016-17	2017-18	Total
No. of Scientists attended HRD programmes							
1	Summer & Winter School/ Short & Refresher Course/ Orientation/ Training	123	117	160	100	156	**656**
2	Workshop/ Group Meeting / Annual Meeting, QRT Meeting	186	133	152	132	146	**749**
3	Seminar/ Symposium/ Conference/ Convention	333	258	244	233	316	**1384**
4	AICRP Monitoring/ Visit of other Centre/ Prelim Exam/ Expert & Guest Lecture	-	109	141	70	141	**461**
	Total	**642**	**617**	**697**	**535**	**759**	**3250**

Table 19: Contd.

Sr. No.	Particulars	2013-14	2014-15	2015-16	2016-17	2017-18	Total
National/State level HRD programmes organized by JAU							
1	National level Seminar/ symposium/ conference/ workshop/ group meet/ training *etc.* organized	04	02	03	05	07	**21**
2	State level Seminar/ symposium/ conference/ workshop/ group meet/ training *etc.* organized	07	03	04	04	01	**19**
	Total	**11**	**05**	**07**	**09**	**08**	**40**

State Level Seminar on "Aadhunik Khetima Pak Sanrakshan : Samasya ane Samadhan" jointly organized by JAU, Junagadh, PPAG and ATMA Project, Junagadh on August 19, 2017

National conference on "Technological changes and Innovations in Agriculture for Enhancing farmers' Income" organized by JAU, Junagadh during May 28-31, 2017

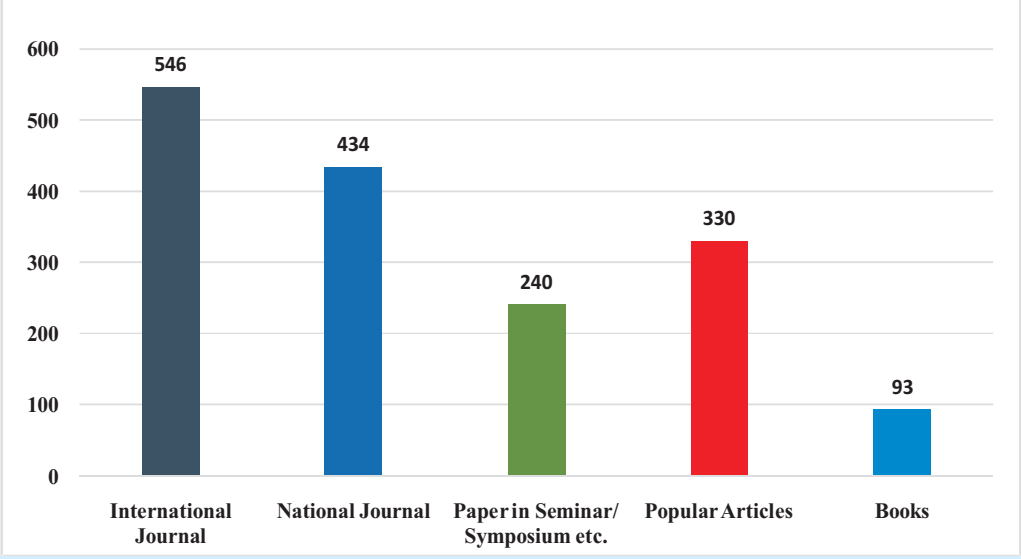


Figure 7. Number of research publications during 2013-18

A major contribution of publication is the transfer of know how technologies among the farmers, scientists and stakeholders in agriculture and allied sectors. During the period 2013-14 to 2017-18, University has made a total of 1643 publications consisting of 546 research paper in international journal, 434 research paper in national journal, 240 research papers in seminar/symposium, 330 popular articles and 93 books.

2.3 Extension Education :

At present, three centres offering certificate courses, Training & Visit Scheme, *Sardar Smruti Kendra*, Farm Advisory Service Centre, seven *Krishi Vigyan Kendras*, Extension Programme for Fisheries, Agricultural Technology Information Centre (ATIC), Centre of Communication (COC), four Transfer of Technology (TOT) centres and Information & Reception Centre (IRC) are functioning in the University. In all the seven KVKs, Extension Programme for Fisheries, ATIC, COC, TOT, Radio Station and IRC are recently added after establishment of the University.

(1) Centres for Certificate Courses

1. Agro-based ITI Centre, Junagadh
2. School of Baking, Junagadh
3. *Mali* (Gardener) Training Centre, Junagadh

(2) Training & Visit Scheme, Junagadh

(3) *Sardar Smruti Kendra*, Junagadh

(4) Farm Advisory Service Centre, Junagadh

(5) *Krishi Vigyan Kendra*

1. *Krishi Vigyan Kendra*, Targhadia (Rajkot)
2. *Krishi Vigyan Kendra*, Jamnagar
3. *Krishi Vigyan Kendra*, Amreli
4. *Krishi Vigyan Kendra*, Khapat (Porbandar)
5. *Krishi Vigyan Kendra*, Nana Kandhasar (Surendranagar)
6. *Krishi Vigyan Kendra*, Pipalia (Rajkot-2)
7. *Krishi Vigyan Kendra*, Gor Khijadia (Morbi)

(6) Extension Programme for Fisheries, Okha

(7) Agricultural Technology Information Centre (ATIC), Junagadh

(8) Centre of Communication (CoC), Junagadh

(9) Transfer of Technology (ToT) Centre

1. Transfer of Technology (ToT) Centre, Junagadh
2. Transfer of Technology (ToT) Centre, Targhadia
3. Transfer of Technology (ToT) Centre, Amreli

(10) Information and Reception Centre, Junagadh

Significant achievements in extension education :

- Initiated Community Radio Station "Junagadh Janvani 91.2 FM" since April, 2015 and telecast radio talk on agriculture and related sectors for around the farmers of Junagadh.
- Established central hi-tech museum "Krishi Darshnalaya" covering all activities and achievement of the university for awareness of visitors like farmers and scientists.
- Celebration of Krushi Mahostsav at village level since 2005.
- Conducted Front Line Demonstration of newly developed production technologies and varieties on farmer field through KVKs.

The Krishi Vigyan Kendras under Directorate of Extension Education conducted 1866 On Campus and Off Campus Training Programmes in which 63469 farmers, farm women and other stakeholders participated during the year 2013-14 to 2017-18 (Table 20). The Training Programmes (156) were organized for Extension Functionaries (6577) to update knowledge related to agriculture and allied sciences under Training and Visit Scheme and KVK activities. The Vocational Training Programmes (309) were organized in which 12895 beneficiaries were trained to start or to strengthen their vocations.

KVKs organized 7008 Front Line Demonstrations to diffuse the improved agricultural practices in farming community. KVKs also conducted 185 On Farm Trials for assessment and refinement of recommended agricultural practices for wider adoption. The Extension Activities (31724) like field days, krushi melas, khedut shibirs, cattle camps, radio talks, publication and distribution of agriculture literature, field visits, etc. were carried out in which 3419203 farmers, farm women and other stakeholders benefitted with latest knowhow. Under, Centre of Communication Scheme 86 activities were carried out with participation of 3432 farmers.

Under, Mera Gaon Mera Gaurav programme 24734 activities including distribution of literature, guidance to farmers, etc. were carried out benefitting

121096 farmers. A month long Mega Extension Events "*Krushi Mahotsav*" were organized in which scientists of various fields were deputed in different extension activities at village, taluka and district level. During the year 2013-14 to 2017-18, five *Krushi Mahotsavs* were organized in which 720533 farmers, farm women and youth got knowledge about agricultural and allied sciences technologies.

Table 20: Extension activities under Directorate of Extension Education (KVKs, SSK, School of Baking, T & V System, COC, MGMG)

Name of Activities	2013-14	2014-15	2015-16	2016-17	2017-18	Total
On Campus and Off Campus Training Programmes (under KVKs)	472 (15294)	366 (12914)	403 (13537)	369 (12675)	256 (9049)	**1866 (63469)**
Training for Extension Functionaries (under KVKs, T & V)	13 (476)	31 (1189)	31 (1224)	41 (2070)	40 (1618)	**156 (6577)**
Vocational Training Programmes	53 (1593)	70 (2837)	58 (1937)	71 (4035)	56 (2493)	**309 (12895)**
Front Line Demonstrations (FLDs) (under KVKs)	684 (684)	650 (650)	933 (933)	2306 (2306)	2435 (2435)	**7008 (7008)**
On Farm Testing (OFT) (under KVKs)	25	39	46	40	35	**185**
Other Extension Activities	7093 (427427)	2276 (760623)	4452 (1032265)	12311 (408790)	5592 (790098)	**31724 (3419203)**
Centre of Communication (COC)	16 (634)	28 (970)	17 (876)	12 (507)	13 (445)	**86 (3432)**
Mera Gaon Mera Gaurav (MGMG)	-	-	14647 (33926)	6811 (58771)	3276 (28399)	**24734 (121096)**
Krushi Mahotsav	(221549)	(196174)	(66916)	(128894)	(107000)	**(720533)**

Note : Figures in parentheses are no. of beneficiaries

Inauguration of Annual Zonal Review Workshop for KVKs

Farmers Field Day on FLD

2.4 Students' Welfare :

The University is always looking forward for the welfare of the students through different activities like sports, cultural, spiritual programmes, NSS, health, adventure, educational tour with a view to develop personality, character and high human values in UG & PG students of the University.

The campus interviews were arranged for placement of students of different colleges. Almost 19 inter-collegiate sports and cultural / literary activities organised by the University every year. The University students participated in All India Inter Agricultural University Sports and Games Meet in every year and obtained ranks/championship in sports and cultural activities like table tennis, disc throw, badminton, high jump, long jump, *tipni ras* and *hudo ras* etc. from 2013-14 to 2017-18. Students also participated in SAU's (Gujarat) Inter Agril. University sports tournaments and so also in Cultural-Literacy Competition at State and National level. Students were also participated in Inter University National Debate Competition, All India Agricultural Universities Youth Festival and Basic Rock Climbing Course. Under NSS, several programmes were organised. Educational tour was arranged for the students of Agriculture, Horticulture, Agricultural Engineering & Technology, Fisheries Science and Veterinary Science. Various scholarships were availed to the students.

Table 21: Student activities

Activity	13-14	14-15	15-16	16-17	17-18	Total
Sports (Inter-College)	16 (710)	15 (745)	15 (760)	15 (778)	15 (818)	**76 (3811)**
(Inter-University)	15 (162)	15 (104)	15 (134)	15 (131)	15 (130)	**75 (661)**
Cultural / Literary Activities	12 (231)	12 (172)	12 (210)	12 (257)	12 (273)	**60 (1143)**
Placement	182	80	56	230	97	**645**

Table 21: Contd.

Activity	13-14	14-15	15-16	16-17	17-18	Total
National Service Scheme (NSS)	21 (1218)	23 (1474)	24 (1611)	26 (1596)	27 (1522)	**121 (7421)**
Gold Medal Recipients	42	43	43	53	56	**237**
Cash Prize Recipients	02	02	02	02	02	**10**
Scholarship Recipients	07 (306)	08 (363)	08 (382)	08 (446)	08 (560)	**39 (2057)**
Students' training programmes	05 (788)	12 (673)	09 (579)	06 (523)	15 (913)	**47 (3476)**
Special Lectures / Programmes	05 (788)	08 (439)	12 (1270)	14 (1348)	25 (1251)	**64 (5096)**
Adventure Camps	01 (103)	02 (84)	03 (149)	02 (159)	01 (96)	**9 (591)**

* Figures in parentheses indicate the number of student participants.

2.5 Finance and Accounts :

Major sources of finance are Government of Gujarat, Government of India, ICAR and other agencies which sanctioned grant through different schemes.

Table 22: Yearwise Expenditure (Rs in lakh)

Particulars	13-14	14-15	15-16	16-17	17-18
Education	7701.43	7982.43	8400.34	8273.19	10753
Research	6726.63	5827.89	6457.29	6793.96	6868.2
Extension Education	1059.55	1226.19	807.99	1415.09	1348.12
Administration	843.43	916.69	1472.99	971.32	1049.99
Construction	1990.28	1973.73	3079.83	3631.85	2020.52
Total	**18321.32**	**17926.9**	**20218.4**	**21085.4**	**22039.8**

2.6 Information Technology :

Junagadh Agricultural University (JAU) provides uninterrupted internet services from Internet Service Providers; like BSNL & Railtel with 100 Mbps high speed to JAU campus and Ishan with 75 Mbps to sub centres. JAU is also connected to

Gujarat State Wide Area Network (GSWAN) through radio connectivity for accessing online Government's programmes. Intranet has been setup for the university users to access various useful freeware, software and services like JAU IT Resource Centres, Online Tour, Online HRD, JAU Exam Management System (JEMS), MGMG Online, Online JAU circulars, Rate Contract, Campus Library, Online bill entry, Online Provident Fund etc. These services have greatly boosted the administration as well as educational, research and extension education activities of the University. All the sub centres of University are connected to university LAN by virtual private networking (VPN) for availing the benefit of these online programmes as well as library database services for research reference. Junagadh Agricultural University has its website having the URL of www.jau.in. This website includes various aspects and activities of Junagadh Agricultural University like Administration, Education, Research, Extension Education, Farmers' Corner, Library facility, important announcements/events, tenders, advertisements, RTI, JAU publications etc.

The University Library possesses 52000 books, 53 Indian journals, 18 foreign journals, 16000 back volumes, 248 e-books, 2 e-journals and 2400 theses. Cyberary with 100 Mbps LAN connectivity enables users with online database like CAB, AGRICOLA, AGRIS& J-Gateplus. Full time internet, scanning and CD writing facilities are available for the students in the Cyberary. CeRA (Consortium for e-resources in Agriculture) and KRISHIKOSH facilities are available in the cyberary section in the library is of good help to the users. BOOK BANK facility also exists for students. The University Library will be fully automized after the implementation of RFID system, the installation of the same is under process.

2.7 Man power :

Table 23: Sanctioned Faculty Strength of the University in Teaching, Research and Extension Education (As on 01.08.2018)

Particulars	Faculty	Technical	Administrative	Total
Education	327	189	312	**828**
Research	207	263	225	**695**
Extension Education	83	82	42	**207**
Total	**617**	**534**	**579**	**1730**

2.8 Estate Management :

The construction & its related works, repairs & maintenance of buildings & roads, water supply, maintenance of drainage system, street light, electrification, repairing of electrical faults, all these works are looked after by the Executive Engineer of the University. ❐

3.0 SWOT Analysis:

Junagadh Agricultural University represents Saurashtra region of Gujarat covering ten districts under its jurisdiction. The area is arid and semi-arid, experiencing frequent droughts, erratic rainfall, low soil fertility and salinity ingress as a result of nearness to Arabian Sea. Literacy rate in the area is > 86 per cent and education facility at high school level is excellent in Saurashtra region in general and Junagadh in particular. Farmers of Saurashtra are enterprising with innovative ideas. Along with farming, animal husbandry is also being adopted extensively. JAU since its establishment is providing triple services of education; research and extension education in agriculture and allied sciences. JAU caters the responsibility of education in agriculture, horticulture, veterinary science, agricultural engineering and fisheries and has added many laurels to its credit. In the similar vein, the University is also providing agricultural technologies and inputs to the farming community. With respect to education, JAU stands shoulder to shoulder directly with the farming community for upliftment of their livelihood. As a result of all these endeavors, the productivity of major crops of Saurashtra is higher than the State and National average levels. The University has responded most dynamically to the needs of the farmers in the region.

The JAU came into existence in May 2004 with the regional mandate for executing and strengthening the triple functions of agricultural education, research and extension education. The University represents the districts *viz.*,Junagadh, Rajkot, Jamnagar, Porbandar, Amreli, Bhavnagar, Surendranagar, Gir Somnath, Morbi and Devbhoomi Dwarka, historically known as Saurashtra, covering about one-third area of the Gujarat State. The University is functioning in a typical arid and semi-arid climate. Hence, drought, erratic rainfall, low fertility and salinity ingress are the major constraints limiting productivity and agricultural production of this region. Despite all these constraints, the University has responded most dynamically to the needs, challenges and opportunities of agriculture in Gujarat and fine-tuned its mandate, plans and programmes accordingly.

3.1 Strength :

The strong foundation for research in Saurashtra started during pre-colonial era

as early as 1852 with the establishment of Fruit Research Station at Mahuva. Similarly, Cattle Breeding Farm was established in 1920 by the Nawab of Junagadh to maintain and improve native breeds of cattle. Research station at Amreli was started during 1926 on *arboreum* cotton. Later on attention was paid on key crops of Saurashtra by establishing research stations on cotton *(hirsutum)* in 1949, oilseeds in 1954 and wheat in 1960.The agricultural education in the region made its beginning with the establishment of College of Agriculture in1960. And ever since the University has kept growing and expanded in spheres of education, research and extension education.

* JAU has eight colleges, eight polytechnics, 31 research stations and 20 extension education centres covering entire Saurashtra region.
* The University has 96 linkages for collaborative activities in education, research and extension education sector with international, national and state institutes.
* Very good infrastructural facilities are available to cater the needs of the stakeholders. These include tissue culture laboratory, food testing laboratory, biotechnology laboratories, greenhouses, seed processing units, machine testing centre, pump testing lab, bio-control lab, biofertilizer lab, instructional & research farms, aquaculture farms, WTO cell, IT cell, Agrisnet studio,central hi-tech museum, central library, engineering workshops, etc.
* ICAR, New Delhi accredited five constituent colleges *viz.*, College of Agriculture, College of Agricultural Engineering & Technology, College of Fisheries Science, College of Veterinary Science & Animal Husbandry and PG Institute of ABM for five years from 28th March, 2016.
* Course structure and syllabus are contemporary and there are mechanisms to make them effective as per Fifth Deans' Committee of ICAR.
* Classrooms, laboratories, computer rooms and conference/ seminar/ examination halls are spacious with good ambience and facilities for the students.
* Fully functional experiential learning units on different aspects.
* Good support from ICAR through development grant for strengthening education.
* Full-fledged residential facilities separately for boys, girls and foreign

students.

* Rich central library with books, periodicals and e-learning resources.
* Excellent indoor & outdoor sports facilities.
* Online examination, education management, HR administration, accounting and procurement systems.
* Diverse soil and climate facilitating cultivation of large number of crops round the year.
* About 788 km long coastal belt which provide potential for fishery sector.
* Availability of multi-disciplinary, highly qualified scientists to take up inter-disciplinary research projects.
* Enthusiastic and dedicated supporting staff.
* Well established/organized research co-ordination of the different faculties.
* A good number of research projects funded by external agencies including several international agencies, is a mark of quality research being done in the University.
* Meritorious and award winning crop improvement research on groundnut, cotton, bajra, sesame, wheat, gram, castor,pigeonpea, vegetables, spices, fruit crops *etc.* and also on production technology.
* Huge basic germplasm of groundnut, bajra, sesame, wheat, cotton, pulses, fruit crops, vegetables and onion & garlic.
* Strategic research on groundwater potential, groundwater recharge and its efficient utilization using remote sensing and GIS tools.
* Research on water management for improving water use efficiency in major crops of the region.
* Well established certified organic farms.
* Saurashtra is the home of famous breed of cattle-Gir cow, Jaffarabadi buffalo, Zalawadi goat and Kathiawari horse.
* University is also a leader in the research of animal breeds viz., Gir cow and Jaffrabadi buffalo.
* Provision of quality seeds of improved varieties of different crops directly to the farmers.
* Commercial production of grafts/saplings of various fruit crops. Elite

hybrid coconut farm.

* Availing biofertilizers, bio-agents, bio-appliances, seaweed extract to farmers at affordable prices.
* Good extension network with seven KVKs in different districts of Saurashtra.
* Training, testing and demonstration facilities on improved farm implements and machineries.

3.2 Weaknesses :

* About 60% of gross cropped area is under rainfed farming.
* Fragmented and small farm/land holdings.
* Lack of small scale agro-based industries at village level.
* Lack of sufficient manpower in the University.
* Inadequate facilities for nano-biotechnological research.
* Scientific manpower not commensurate with vast and numerous challenges.
* Lack of international exposure to the scientists.
* Basic and strategic research gap which is essential for the advancement of science.
* Lack of resources and manpower for diagnostic surveys which are drawbacks in research and extension effectively.

3.3 Opportunities:

* With the globalization of the markets there is a growing demand of highly trained manpower in the specialized subjects of agriculture and allied sciences.
* Scope for e-communications and e-extension of research findings.
* Opportunities exist for export of value added agro-products.
* Scope for entrepreneurship development for custom hiring of high capacity and costly machinery.
* Potential of employment generation through agro-processing centres at village level.
* High potential for using renewable energy sources.
* Vast scope for farm mechanization.

* Opportunity for the establishment of the Centre for Advanced Faculty Training in the University.
* Development of Veterinary College as referral institute for cattle as well as wild life health and management services.
* Geographical information system, remote sensing, and crop modelling can be emphasized to generate new concepts, tools and methodologies based on system approach.
* Identification and characterization of gene pods and gene mapping.
* Forensic Research Institute for Agriculture may be established.
* DNA Bar-coding of biodiversity.
* Providing a cost effective and simple technology for the production of biodiesel from the single cell algae.
* Department of Agril. Microbiology etc. can be established.
* Induction of variability in important medicinal plants and their genetic improvement.
* Establish linkages with other organizations to provide molecular level solutions to the field problems, value addition and food processing, integrated nutrient management, integrated pest and disease management.
* Good scope for recycling of crop residues, organic farming, precision farming, integrated farming system research, protected cultivation, and wasteland development.
* Monitoring and mitigation of climate change and adaptation strategies.
* Development of transgenic varieties of major crops.
* Scope of partnership with public, private, national and international organizations.
* Saurashtra has a vast coastal area for marine fisheries. A large number of fisheries industries in coastal area for boosting the export of marine products.
* Scope of research on coastal area management, brackish water aquaculture and wasteland ecology management.
* Potential for startups/incubations on agro-processing, biofertilizers, bio-agents, bio-compost, bio-appliances, seed production, farm machinery and equipments, testing laboratory, tissue culture, nursery, mushroom,

apiculture, floriculture, etc.

* Space for area specific integrated farming systems for small and marginal farmers.
* Scope for agro-tourism.

3.4 Threats:

* Less irrigation facilities, erratic distribution of rainfall, droughts, floods and cyclones of high frequency & intensity, irrigation water scarcity, limited availability of farm land.
* Salinity ingress in the coastal areas of Saurashtra.
* Climate change has brought the changes in precipitation pattern, more unpredictable and unseasonal rainfall, the frequency of extreme weather events like storm, cyclone, flood, heat waves, cold waves, etc. This has severely affected the crop production and biology of insect-pests as well as the atmosphere.
* Due to poor monitoring and regulations, over exploitations in capture fisheries and heavy stocking in aquacultue, it leads to depletion of stocks and mortalities respectively which results in fluctuations in fish harvest and local economy.
* Decreasing per capita land holding.
* Stagnation in the yield, unabated growing pollution, continuous use of chemicals and pesticides with harmful residues, depleting resources and many other adversities are growing.
* Deteriorating groundwater quality and depleting groundwater level.
* Emergence of private sector in agricultural education.
* Disposal of solid waste, sewage and effluents from urban areas and industries.
* Depletion of soil organic carbon leading to deterioration of soil health and productivity.
* Migration of rural people to urban area resulting in farm labour shortage.

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4.0 JAU Mandates:

4.1 Vision: Agriculturally prosperous Saurashtra region and Gujarat.

4.2 Mission: To provide education, research and extension education services related to agriculture and allied sciences, thereby to develop competent human resources and technologies to serve farming community in general and society in particular and making Saurashtra and Gujarat agriculturally prosperous.

4.3 Goals and Objectives: Junagadh Agricultural University will focus on the following key areas in education, research and extension education activities to realize both vision and mission.

4.3.1 Education:

- Endowing quality education to produce globally competitive graduates and post-graduates in different areas of agriculture and allied sectors.
- Imparting skills/training to rural youth through agricultural education for developing entrepreneurs, managers, agro-industrial workers and above all progressive farmers with a global perspective and a strong commitment to sustainable growth in agriculture.
- Strengthening individual faculties and students for leadership, good governance and innovation by organizing need based capacity building programmes.
- Strengthening existing centres and establishing new research stations and specialized research laboratories for taking up research and its application in agriculture, horticulture, agricultural engineering, animal husbandry, dairy and fisheries sciences.

4.3.2 Research:

- Increasing crop productivity through genetic improvement and making available ample quantity of quality seed of newly developed varieties to farmers for important crops like groundnut, cotton, pearl millet, castor, wheat, chickpea, pigeon pea, sesame, vegetables, seed spices etc.
- Production of good quality planting materials of fruit crops, flowers and medicinal crops for distribution to farmers.
- Exploring the untapped potential of kitchen gardening in the form of

rooftops and backyards.

- Research on high density planting, efficient canopy management, eco-friendly and integrated nutrient/pest management, production, processing, storage and varietal improvement in mango, sapota and plantation crops.
- Protected cultivation using net and poly house for cash crops, vegetables, medicinal plants and floriculture.
- Research on integrated management of plant protection for control of major diseases/pests through use of cultural practices, bio agents/herbal pesticides and optimum use of chemical pesticide in the major crops of the region.
- Research on integrated nutrient management using organic, inorganic and bio-fertilizers, appropriate irrigation/water conservation systems and production technology to minimize the input use and maximize its efficiency for sustainable agriculture under rainfed as well as irrigated conditions in the region.
- Sustenance of soil productivity and health by organic / cow-based farming.
- Enhancing farmers' income through farm intensification, crop diversification and by reducing cost of cultivation.
- Soil and water conservation through suitable water harvesting techniques and utilization of micro irrigation practices through computerized remote sensing technique.
- Application of frontier science technologies such as biotechnology and nano-biotechnology for improving production in agriculture and allied sectors.
- Harnessing the benefits of bio-nano technology for developing stress tolerant cultivars.
- Development of mitigation strategies and climate resilient varieties/ technologies to reduce adverse impact of climatic change on agriculture, livestock production and allied sectors.
- Developing technologies for reduction of post-harvest losses and value addition through processing.
- Reducing cost of cultivation and human drudgery through farm mechanization along with human safety and comfort.
- Exploring the possibilities of harnessing renewable sources of energy for utilizing in agricultural production and processing including the recycling of biomass and agricultural waste.
- Utilization of agro-industrial by-products and crop residues in the production of value-added products.

- Addressing the food quality and safety issues through scientific interventions.
- Development of varieties / hybrids and products fortified with vitamins and minerals for addressing malnutrition.
- Improving animal health care and delivery systems for efficient milk production.
- Improvement and maintenance of pure *Gir* Cow and *Jaffrabadi* Buffalo through pedigree selection and artificial insemination using proven bulls.
- Development and diversification of freshwater/brackish water aquaculture with potential species such as mud crab, oysters and mussels.
- Ornamental fish culture research with particular reference to breeding and feed formulation as well as application of remote sensing technique to augment marine fish production.
- Increasing and stabilizing farmers' income through integration of agri-horti-animal-fish components for small and marginal farms.
- Reclamation of problematic soils and use of brackish water in agriculture.

4.3.3 Extension Education:

- Fostering linkages and collaborations with public-private organizations at national and international level.
- Improving the knowledge management system for efficient technology dissemination through innovative use of Information and Communication Technologies.
- Intensifying existing transfer of technology programmes for effective farming and capacity building.
- Demonstration of proven production and processing technologies on quality aspects through on-farm demonstrations.
- Acting as a knowledge dissemination centre for information related to agriculture, animal husbandry, fisheries and allied sciences through publications, information broad casting system and other advanced means of mass media communication.
- Prioritizing market intelligence based crop planning systems by leveraging the usage of ICT tools for information dissemination and feedback.
- Unleashing and upscaling start-ups / incubation in agriculture, especially among the student community.

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5.0 Strategy and Framework:

The following strategies would be adopted to accomplish vision and goals of Junagadh Agricultural University and to enhance efficiency and effectiveness of its education, research and extension education related activities.

Sr. No.	Goal	Approach	Performance measure
5.1	**EDUCATION**		
5.1.1	**Agriculture**		
1.	Creation of quality human resources to address emerging challenges in agriculture	• Modernize education system (infrastructure, faculty, generation of new aids and modules in teaching). • Internalize problem solving approach in curricula (increase analytical skills, increase experiential learning, greater focus on science and processes). • Effective coordination of multi-disciplinary education & research. • Strengthening of polytechnics. • Establishment of new departments (microbiology, virology, toxicology & nematology, nanotechnology, organic farming, meteorology). • Capacity building through training on current topics related to teaching and research at National & International levels. • Strengthening of the e-library.	• Produce qualified and trained manpower in agriculture and allied sector. • Upgradation of faculty resulting in better quality teaching. • Improvement innational and international cooperation in teaching & scientific research area. • Increase student mobility, visibility & recognition of the faculty on all levels. • Develop linkages with related institutes for e-library. • Establishment of new biological science departments such as microbiology, virology, toxicology & nematology, nanotechnology, organic farming, meteorology.
2.	Transforming examination system	• Use of information technology in evaluating students' performance. • Conducting and updating online examinations including entrance test.	• Speed and accuracy in examination results. • Competence of students produce.

Sr. No.	Goal	Approach	Performance measure
3.	Establishment of Department of Agricultural Information Technology	• UG and PG courses in Agricultural Information Technology. • Training programmes and short-term courses on agro-informatics, internet services, agriculture software, data communication & networks, agriculture knowledge management system, etc. in various fields of agriculture & allied sectors.	• Generate qualified professionals with IT knowledge applicable to agriculture. • Improve functioning in academic, research, accounting and administrative works.
4.	Establishment of at least one new agricultural college at each district of the Saurashtra region.	• UG programmes customized to the localized needs. • Focus on generating entrepreneurs in the agricultural sector.	• Increase the intake of students from the existing strength so as to cater the future market demand. • Increase the number of agripreneurs in the region.
5.1.2 Horticulture			
1.	Creation of quality human resources to address emerging challenges in horticulture	• Increasing intake capacity of UG programme. • Strengthening existing College of Horticulture. • Establishment of full-fledged Departments like Fruit Science, Floriculture, Vegetable Science, Post-Harvest Technology (PHT), NRM, Plant Protection, Social Science, Basic Science, *etc*. • Initiation of PG degree programmes in Post-Harvest Technology (PHT), NRM, Plant Protection, Social Science, Basic Science, *etc.* • Modernize education systems (infrastructure, faculty improvement, generation of new aids and modules in teaching). • Internalize problem solving approach in curricula (increase analytical skills, practical knowledge, experiential learning *etc).*	• Improvement of education system in horticulture discipline. • Effective co-ordination of multi-disciplinary education & research.
2.	Upgradation of knowledge and skill of the faculties	• Attainment of training for faculties on recent developments in horticultural science. • Generate specific teaching aids in horticulture faculty.	• Upgradation of faculty resulting in better quality technology. • Produce qualified and

Sr. No.	Goal	Approach	Performance measure
			trained manpower in horticulture and allied sectors.
3.	Transforming examination system	• Use of information technology in evaluating students' performance. • Conducting and updating online examinations including entrance test.	• Speed and accuracy in examination results. • Competence of students produce.
5.1.3 Agricultural Engineering & Technology			
	To develop competent human resources trained in the field of Agricultural Engineering & Technology	• Establishment of another College of Agril. Engg. and Tech. in Saurashtra region of Gujarat. • Establishment of Department of Basic Engineering and Applied Sciences at CAET, JAU, Junagadh. • Establishment of Polytechnic in Agricultural Engineering in each district of Saurashtra. • Establishment of undergraduate Degree programme in Food Processing Technology. • Establishment of Degree programme in Renewable Energy & Environmental Engineering at UG level.	• Generation of qualified and specialised manpower. • Increase in the number of students qualifying in various national level competitive examinations such as GATE, JRF, SRF, CAT and NET. • Increase in the number of students qualifying in various international competitive examinations such as GRE, TOEFL and others and securing admission in foreign Universities.
2.	Transforming education system and strengthening of education in Agricultural Engineering & Technology	• Establishment of new laboratories and modernization of present laboratories at CAET, JAU, Junagadh. • Strengthening of polytechnic in agro processing at Junagadh. • Strengthening of all existing departments of CAET, JAU, Junagadh. • Inclusion of courses in Undergraduate and Post Graduate programmes related to Information and Communication Technology (ICT), Artificial Intelligence (AI) / Machine Learning (ML), Application of Robotics and Drone Technology in Agriculture, Remote Sensing and GIS for water resources, Soil Less Media and Hydroponics in	• Increase in the number of students placed in various reputed organizations in Gujarat and India. • Promoting the placement of students in foreign countries.

Sr. No.	Goal	Approach	Performance measure
		Agriculture, Agricultural Production under controlled environment, Advances in tillage Technology, Cryogenic Grading of seedspices, Canning Technology, Cereal Processing and Packaging Technology.	
3.	Strengthening the PG research in various fields of Agricultural Engineering & Technology	• Establishment of Department of Irrigation & Drainage Engineering with PG education at CAET, JAU, Junagadh. • Two separate departmentsi.e. Farm Machinery Engg. and Farm Power Engg. from FMPE department and strengthening of both departments. • Establishment of Master's and Ph.D. research programmes in Solar Energy, Wind Energy and Bio Energy. • Development of CAD/CAM computerized laboratory. • National and international collaboration in PG research.	• Increasing h-index withpublications of faculty and students in various reputed national and international journals, books and book chapters. • Promoting start-ups / incubation among students. • Encouraging the development of patented technologies. • Increase the engagement of students in external funded research projects.
4.	Upgradation of knowledge and skill of the faculty and students anddissemination of Agricultural Engineering & Technology	• Establishment of short term training Certificate Courses on Farm Machinery & Power / Soil and Water Conservation / Irrigation Engineering & Technology / Processing and Food Engineering / Value Addition / Food Technology / Renewable Energy Engineering. • Establishment of incubation centre in value addition to train small entrepreneurs, farmers and students in the field of value addition technology. • Establishment of Skill Development Centre for Agricultural Engineering graduates. • Establishment of Irrigation Technology Park for teaching and demonstration purpose. • Strengthening of Farm Implements Testing Centre for testing of modern tools and Farm Implements.	• Innovative projects undertaken by students. • Increase in number of farmers and manufacturers for visiting and observing the demonstration of technology. • Increase in number of farm implements and machinery tested and certified. • Enhancing the scope of marketing of products produced in various ELPs and hands-on-training Programmesto generate profits. • Replication of start-up initiatives in rural areas of Saurashtra region.

Sr. No.	Goal	Approach	Performance measure
5.1.4 Fisheries			
1.	Upgradation of UG and PG programmes	• Raising the intake of PG programmes. • Introducing new disciplines for Master degree (e.g. Fish nutrition and health, Fish Health Management, Fish Genetics and Breeding, Aquatic Environment). • Establishment of new departments *viz*. Fisheries extension; Fisheries economics; Artificial Intelligence in Fisheries; Fish business management (FBM); Fisheries Engineering; Fisheries Nanotechnology; Fish Pharmacology and Toxicology; Remote Sensing and GIS in Fisheries Management; and Oceanography, Hydrology and Marine water resources. • Strengthening of UG and PG labs. • Faulty exchange and training programmes. • Collaboration with national and international institutes as well as with industries for PG research. • Focus on skill and entrepreneurship development programmes for UG students. • Creation of demonstration-cum-training centre on specific areas.	• Improvement in education and PG research output through publications and patents. • Produce qualified and trained manpower for fisheries sector in emerging areas. • Enhancing success rate in JRF/SRF/NET/ARS examination. • Promoting entrepreneurship among graduates in fisheries and allied sectors. • Improving annual intake capacity in UG and PG programmes.
2.	Transforming examination system	• Use of information technology in evaluating students' performance. • Conducting and updating online examinations including entrance test.	• Speed and accuracy in examination results. • Competence of students produce.
3.	Establishment of food and feed processing lab	• Development of species specific feed for aquaculture practice. • Development of ready-to-use type of seafood products.	• Economic and sustainable culture of fish and shellfish. • Trained and skilled manpower development required in farm and industries. • Skill & entrepreneurship development. • Revenue generation by

Sr. No.	Goal	Approach	Performance measure
			marketing of feed and food.
4.	Development of business model for fish seed, feed, processing & value addition	• Demonstration cum training centre for marketable products at village level. • Incubation centre for entrepreneurship.	• Improvement in livelihood and socioeconomic development of fisher folks. • Replication of incubation centres/start-up programmes at village level.
5.1.5 Veterinary Science & Animal Husbandry			
1.	Strengthening institutional capacities in veterinary science	• Upgradation of students' amenities. • Modernization of laboratories, instructional farm and teaching veterinary clinical complex. • Strengthening entrepreneurship. • Establishment of Remount and Veterinary Corp (RVC) facilities. • Execution of institutional development activities.	• Generate well qualified manpower in veterinary and animal husbandry. • Update teaching techniques. • Better quality of student activities. • Improved entrepreneurship in veterinary profession.
2.	Developing the national as well as international reputed destination of choice for academic and research	• Establishment of collaboration with other national/international institutes of repute for students and faculty exchange. • Inducing the curiosity and practical knowledge gain among students. • Proposal for need based post graduate diploma courses. • Faculty competence improvement by training abroad.	• Students opting for own start-ups and creating jobs for others. • More number of students to clear competitive examinations like ICAR-JRF, SRF and NET. • Increasing demand of students to fulfil the need of veterinary professionals for the society.
3.	Developing new courses such as Diploma in Animal Husbandry and other UG programmes	• Establishment of new constituent Veterinary Colleges as per the guidelines of Veterinary Council of India in the jurisdiction of the University. • Establishment of constituent Polytechnic in Animal Husbandry.	• To generate qualified manpower in the areas of Veterinary Science and Animal Husbandry. • To generate skill supportive manpower for Animal Husbandry sector.
5.1.6 Agri-Business Management			
1.	To improve short, medium and long term educational programmes	• Development of UG program in agribusiness. • Aggressive niche strategy for the development of course curriculum. • Linkages with agro based industries. • Distance Learning and	• Qualified manpower for agro-based industries and Universities. • Solution for the managerial problems of stakeholders. • Development of need based learning modules.

Sr. No.	Goal	Approach	Performance measure
		Certificate course in agri-business. • Creation of modern management tools and techniques.	
2.	Contribution to develop agri-business environment	• Development of industry interface to upgrade the course curricula for MBA (AB) and Ph. D. (AB). • Encouragement of potential agripreneurs and producing competent agri-business professionals. • To promote the concept of commercial agriculture and farming as an enterprise. • Expansion of MDPs and training programmes. • Development of Industry Interface Cell. • To enhance the professional consulting capacity among the faculties.	• Engagement of agri-business students through summer trainings, research projects and permanent placement with reputed organizations. • Entrepreneurship skill developed by agri-business students. • Development of intellectual capacity and managerial skill of trainees. • Contribution of agri-business students as a trainee, through research or industry interaction in different capacity.
3.	Strengthening of existing PGIABM	• Creation of departments viz., Human Resource Management, Operational Research Management, Agricultural Economics and Business Policy, Agricultural Marketing Management and Financial Management & Accounting to strengthen the agri-business faculty.	• Interface with stakeholders like students' community, agribusiness corporate & companies, FPOs, Co-operatives and NGOs. • Improvement in education and research output. • Establishing a vibrant networking set-up among the graduates for improving job prospects. • Developing quality and highly successful entrepreneurs.
5.2 RESEARCH			
5.2.1 Crop Improvement			
1.	Genetic upgradation through hybridization	• Genetic enhancement and population improvement in diploid and tetraploid cotton. • Development of Bt/ NBt long linted *G. hirsutum* varieties/ hybrids with high yield potential and fibre quality. • Development of genotypes for early and late heat tolerance in	• Generation/development of high yielding varieties/hybrids and breeding materials/lines with improved characters. • Development of new lines resistant to biotic and abiotic stresses. • Evolvement of basic

Sr. No.	Goal	Approach	Performance measure
		wheat for climate change. • Development of short duration varieties suitable for Saurashtra conditions in wheat, chickpea, cotton and castor. • Development of early and inputs responsive hybrids for good quality summer bajra cultivation. • Development of early or medium late maturing MS lines in bajra. • Development of large seeded & confectionary groundnut varieties. • Development of high yielding and early to medium maturity hybrids in castor. • Development of high yielding medium late maturing pigeon pea varieties. • Development of high yielding, better quality and disease/pest resistant genotypes in major crops. • Generation of genetic variability for resistance to biotic and abiotic stresses through use of wild relatives in mandate crops. • Development of CGMS lines in related crops. • Gene pyramiding for the development of disease resistant varieties in mandate crops. • Marker assisted selection for biotic, abiotic and quality traits. • Diversification of male sterile lines through development of downy mildew resistant CMS lines in A5 and A4 sources in pearl millet. • Development of physiologically efficient plant types. • Development of varieties for sustainable production under intensive management conditions for mandate crops.	potential genetic material for further research work. • Generation of new male and female lines as well as MS lines for the development of hybrid varieties. • Development of input use efficient crop varieties /hybrids.
2.	Maintenance and utilization of genetic resources	• Establishment of Gene Bank for conservation of biodiversity in mandate crops.	• Maintenance and enrichment of biodiversity in mandate crops.

Sr. No.	Goal	Approach	Performance measure
		• Collection, conservation, characterization and evaluation of available genetic resources. • Identification and utilization of resistance sources against major biotic and abiotic stresses in mandate crops. • Cataloguing of accessions based on morphological, phenotypic and genetic characteristics in crop plants. • Development of core set of germplasm and identification of trait specific germplasm. • Exploration of germplasm of minor vegetables, pulses and seed spices. • Identification, characterization and conversion of photo-period insensitive germplasm accessions to make them suitable for the region. • Multi-location evaluation in target environment for identification of trait specific (tolerant to biotic and abiotic stresses; biochemical profiling including quality parameters; NUE,WUE, carbon use efficiency, etc.) germplasm for use in crop improvement. • Evaluation of available germplasm under organic cultivation in mandate crops. • Pre-breeding/conversion of unabated germplasm of cultivated species of cotton into usable and early synchronized maturity & value added varieties.	• Documentation of available germplasm in crops for further utilization in breeding programmes. • Identification of potential donor parents for different economic traits for their utilization in crop improvement programmes. • Genetic materials with adequate variability for the development of new varieties. • Evolving promising varieties by exploiting the genetic variability including the exotic germplasm characterized to meet the challenges of biotic and abiotic stresses, which sustainthe impact of climate change besides yield, quality and nutritive values.
3.	Breeding for yield and quality improvement	• Development of high yielding, early and synchronized maturity cultivars amenable to machine harvesting in cotton, pigeon pea and chick pea. • Development of high yielding onion varieties with high TSS for processing & export and big cloved garlic varieties.	• Improved varieties/hybrids of crops with better yield & quality attributes. • Enhancement of total production & productivity in mandate crops. • Development of crop varieties/hybrids suitable for changed climatic conditions

Sr. No.	Goal	Approach	Performance measure
		• Development of cotton varieties/hybrids suitable for high density planting. • Breeding varieties for high nutritive values in mandate crops, fibre quality in cotton and fortified varieties in pearl millet and wheat. • Development of high oil and high O/L ratio containing groundnut/ sesame varieties. • Breeding for resistance to specific diseases in the crops of the region. • Development of crop varieties/hybrids suitable for processing, export & confectionery purposes in important crops. • Use of biochemical tools to improve resistance/ tolerance to biotic and abiotic stresses in mandate crops. • Development of vegetable varieties/hybrids suitable for off season/ harsh condition in important vegetables for processing, export &dehydration purposes. • Development of genetic material using speed breeding programme.	and high density planting. • Development or identify aflatoxin, sterility mosaic virus and yellow vein mosaic virus resistance groundnut varieties or genotypes. • Development of varieties suitable for processing and exports. • Development of genetic material in short duration.
4.	Development of resistant/tolerant varieties against temperature, photo periods, salt and drought stress and climate change	• Evaluation of available germplasm for stress condition in mandate crops. • Pre-breeding with allied species of the crops. • Conventional breeding approaches with field evaluation for abiotic stress resistance. • Development of varieties suited to mechanical harvesting.	• Identification of elite lines for specific traits. • Development of crop varieties/hybrids with improved traits. • Improved plant types suitable for mechanical harvesting.
5.	Seed quality enhancement	• Maintenance breeding of parental lines and varieties, purity maintenance during seed production and DUS characteristics under PPV & FRA regulatory.	• Availability of quality seed for enhanced seed replacement rate and production.

Sr. No.	Goal	Approach	Performance measure
		• Seed quality enhancement and production of quality seed in mandate crops.	
5.2.2 Basic Sciences			
A. Biotechnology			
1.	Upgrading and strengthening of biotech research centre	• Understanding the physiological, genetic and molecular mechanisms underlying abiotic and biotic stress tolerance. • Molecular basis of male sterility and fertility restoration. • Cloning and characterization of novel genes of agronomic importance. • DNA fingerprinting of varieties released by JAU. • Molecular analysis of important plant pathogens, pathotyping and host pathogen interaction. • Molecular breeding for stress tolerance. • Map based gene cloning and markers for MAS. • Genetic engineering for resistance to pathogens. • Genome sequencing of crop plants and microorganisms.	• Stress tolerant crop cultivars & transgenics. • Novel genes for crop improvement. • Marker assisted selection for agronomic traits in breeding programme. • Germplasm/varietal identification and their conservation. • Cataloguing of important plant pathogens prevalent in Gujarat. • Pathogen-resistant transgenic crop plants. • Gene constructs and gene sequences to develop gene based markers.
2.	Establishment of agricultural forensic research institute	• Creation of infrastructure. • Linkages with forensic laboratories. • Identification and prioritization of areas of research. • Creation of modern tools and techniques for agricultural forensic research.	• Analysis of samples and queries of agriculture oriented issues.
3.	Establishment of the genome data base for the crops of Gujarat	• Big data analysis.	• Genomics of major crops.
4.	Gene editing in major field crops of Saurashtra	• Use of CRISPER-CAS9 technology in breeding programme. • Gene editing training for faculty / PG students.	• Development of CRISPER-CAS9 genetic material. • Specific gene editing training in major crops.
B. Biochemistry			
1.	Nano-fertilizers	• Industry approach	• NPK & micronutrients nano-

Sr. No.	Goal	Approach	Performance measure
	pilot scale production unit		fertilizers.
2.	Organic farming promotion	• Pesticide residue analysis.	• Registered organic farmers.
3.	Diagnostic based on metabolites	• Analytical approach related to disease, pesticide and nutraceuticals.	• Samples analyzed.
4.	Abiotic stress tolerance in agricultural crops	• Metabolomics and proteomics approaches.	• Identification of biochemical and molecular markers related to stress tolerance in crops.
5.	Production of elite planting materials	• Development of tissue culture protocols for important horticultural crops. • Endow the farmers with quality planting materials. • Development of protocol for anther culture and multiplication of highly recalcitrant crops. • Standardization of protocol for embryo rescue technique.	• Multiplication of improved crop varieties of horticultural crops.
6.	Development of biodiversity park and encouraging production of quality planting material of medicinal and aromatic plants	• Introduction of germplasm of medicinal & aromatic plants. • Establishment of short term storage seed bank. • Development of biodiversity parks with automated domes. • Development of facilities for long term storage of seed through cryopreservation. • Fingerprinting of medicinal and aromatic plants germplasm.	• Enrichment of plant biodiversity and multiplication of important species.
C. Plant Physiology			
1.	Identification of basic physiological mechanisms contributing differential yield response of mandatory crops of the region	• Establishment of modern laboratory. • Identification of morphological, physiological and biochemical parameters for rapid screening of drought, cold, heat and salinity tolerance/resistant crop genotypes. • Use of different PGRs and biomolecules for seed treatment/ foliar spray for yield enhancement. • Research on basic and applied	• Identification of plant ideotypes with desirable traits.

Sr. No.	Goal	Approach	Performance measure
		aspects of plant growth and development, plant metabolism, micronutrients, growth regulators and abiotic stresses. • Screening of varieties for enhancing input use efficiency and stress tolerance. • Refining methodologies for climate change vulnerability. • Study on molecular aspects of plant physiological processes particularly under changing environmental conditions.	
2.	Reducing transpiration water losses	• Stomatal activity regulation. • Use anti-traspirants.	• Molecular and biochemical approach.
D. Seed Science			
1.	Improvement of seed germination and storage capacity of seeds	• Establishment of functional seed testing laboratory and model small scale seed processing plant. • Studies on seed dormancy. • Establishment of genetic purity testing laboratory. • Development of protocol for seed priming, coating and pelleting for low volume and high value seeded crops by exploiting nano-technology.	• Improvement in seed germination and storage capacity involving scientific and commercial technologies. • Increase in production and productivity.
2.	Human resource development for seed production	• Conduct short term and long term trainings for seed entrepreneurs.	• Start Ups/Incubations for seed production.
3.	Isolation study for GM crops	• Standardization of isolation distance for GM crops.	• Isolation distance requirements in GM crops.
4.	Establishment of seed bank	• Cryo preservation of seed.	• Seed conservation of major crops.
5.2.3 Plant Protection			
1.	Bio-control of pests and diseases	• Research on beneficial microbes and insects for control of pests and diseases. • Screening of promising micro-organisms and insects *in vitro* and *vivo*. • Testing of field performance of bio-control agents. • Acclimatization and	• Production of effective bio-agents for control of pests/diseases. • Production of pesticides residue free agricultural produce. • Reduction in environmental pollution i.e. soil, water and air contamination.

Sr. No.	Goal	Approach	Performance measure
		sustainability of bio-control agents in ecosystem. • Standardization and quality production of bio-control agents.	
2.	Integrated pest and disease management	• Development of guideline for incorporation of non-chemical methods in pest and disease management. • Evaluation of new micro-molecules and optimization of dose of pesticides with reference to pest ecology. • Quantification of pesticides residue in agricultural produces. • Developing IPM/IDM modules for important crops.	• Optimization in the use of bio-control agents, less toxic chemicals/non-chemicals and cultural practices in management of pests & diseases. • Reduced input cost and pesticides residue in agricultural produces.
3.	Development of new technologies for the insect-pests management	• Development of semio-chemical technologies for monitoring and management of insect-pests of major crops.	• Production of effective semio-chemicals for better management of major pests of cash crops. • Reduction of pesticides usage.
4.	Additional income generation through apiary and mushroom	• Setting up of low cost apiary in the farms. • Setting up of the low cost mushroom units.	• Increase in the income and crop yield through efficient pollination.
5.	Production of bio-fertilizers and recycling of agricultural waste	• Isolation, screening and testing of efficient microbes for rapid decomposition of agricultural waste and biofertilizers.	• Reduced the use of chemical fertilizers. • Increase soil fertility and crop yield. • Production of biofertilizers and waste decomposing microorganisms.
6.	Screening of insect pests and diseases resistant germplasm/ varieties	• Development of disease sick plot for screening breeding material. • Identification of hot spot area for screening varieties/germplasm for insect pests.	• Use of screened materials for breeding insect-pests and diseases resistant varieties, ultimately reduced use of pesticides and improve yield and reduced cost of production.
7.	Climate resilient plant protection	• Developing climate-smart plant protection technologies.	• Development of contingency plan to mitigate the risk of insect pests epidemics under climate change.
5.2.4 Natural Resource Management			
1.	Integrated nutrient management	• INM through integration of chemical, organic and biological	• Maximization of crop yield. • Improvement in soil health.

Sr. No.	Goal	Approach	Performance measure
		sources for mandate crops. • Efficient use of different oil cakes. • Use of cow-based formulations and botanicals. • Testing of efficient strains of N, P, K and S fixing/solubilising microbes. • Conservation agriculture. • Biofortification/ biopriming of essential nutrients in different food crops.	• Reduced use of chemical fertilizers. • Quick and effective decomposition of crop residues. • Improvement in carbon sequestration.
2.	Organic farming	• Use of organic manures, biofertilizers, cow-based formulations and botanicals. • Recycling of crop residues/ farm waste through ex-situ and in-situ management. • Non-chemical methods of pest-disease management. • Use of non-chemical methods of weed management and testing their effectiveness. • Development of multi-microbiaenriched organic manures. • Production of organic inputs. • Development of model organic farm.	• Improvement in quality of farm produce. • Production of chemical residue free produce. • Reduction in input cost. • Improvement in soil health, carbon sequestration and environment. • Package of Practices for low cost natural farming.
3.	Efficient utilization of water	• Evaluation of micro irrigation in different crops and cropping systems. • Water saving techniques. • Introduction of crops having less water requirement. • Technology for use of waste water and poor quality water for crop production. • Microbial techniques for purification of sewage /saline water. • Screening crop varieties against poor quality irrigation water. • Survey and mapping of poor quality irrigation water in Saurashtra region.	• Improved WUE and water productivity. • Saving of irrigation water. • New crops having less water requirement. • Performance of crop varieties against waste water and poor quality irrigation water.
4.	Development of dry farming	• Crop production under dry farming by managing soil and	• Improved soil and moisture conservation.

Sr. No.	Goal	Approach	Performance measure
	technologies	water scientifically and efficiently. • Developing low cost technologies for in situ moisture conservation and water harvesting. • Technology for alternate use of saline water. • Contingent crop planning. • Development of IFS model suitable for dry farming.	• Increased water productivity. • Increase in crop production and farm income per unit area.
5.	Weed management	• Incorporating non-chemical methods (cultural/ mechanical/ physical/ biological and agronomic manipulation) with chemical method of weed management. • Evaluation of new herbicides, their mixtures and optimizing their time and dose of application for weed management. • Dynamics of weed seedbank in soil. • Quantification of herbicide residues in soil, water and plant parts and their consequent entry in the food chain. • Management of herbicide residues in soil. • Survey and cataloguing of weed flora in Saurashtra region.	• Efficient integrated weed management practices. • Reduced herbicide residues in plant and soil. • Tackling farm labour shortage • Status of weed flora in the region.
6.	Management of problem soils	• Use of organic and inorganic amendments for soil reclamation. • Bioremediation of problem soils. • Survey and delineating area of problem soils. • Screening of crop varieties suitable for problem soils.	• Improved soil health and productivity. • Sustainable crop production • Identified crop varieties suitable for problem soils. • Status of problem soils area.
7.	Input use efficiency	• Evaluation of customized fertilizers. • Use of water soluble fertilizers to increase the nutrient and water use efficiency. • Development of technologies for nano-fertilizers. • Site-specific nutrient management and real time	• Enhancement in input use efficiency. • Saving in fertilizer dosage.

Sr. No.	Goal	Approach	Performance measure
		nutrient management through SPAD meter, LCC, optical sensor- based nitrogen management.	
8.	Climate resilient agriculture	• Developing climate-smart agricultural technologies for adaptation and mitigation to climate change. • Biotic and abiotic stress management • Development of ICTs and digital services for climate smart agriculture. • Impact assessment of climate change in agriculture. • Testing and validation of crop models for Saurashtra region.	• Managing vulnerability to climate change in agriculture. • Developed contingency plan for mitigating risk in agriculture under climate change.
9.	Integrated farming system models for small and marginal farmers	• Horizontal and vertical diversification for generating more income and employment. • Development of diversified cropping systems with other existing farm enterprises or new/modified enterprises for generating more productive integrated farming system modules for different land holdings. • Recycling and intermittent use of farm products, by-products, residues and wastes for reducing cost of production. • Development of homestead farming systems. • Development of ecotourism models to supplement farm income.	• Increase in farm yield, net income, employment, energy use efficiency, carbon sequestration *etc.*
5.2.5 Horticulture			
1.	Advance research in fruit crops including coconut	• Development of high yielding varieties/ hybrids. • Research on effect of climate change. • Standardization of rootstocks and grafting techniques and planting material. • Research on flowering behaviour, HDP, canopy	• Increase in production. • Development of varieties /hybrids. • Organic package of practices. • Value addition for export promotion and reduction in post-harvest loss. • Supply of quality planting

Sr. No.	Goal	Approach	Performance measure
		managementin mango. • Research on HDP and canopy management in guava, custard apple and pomegranate. • Rejuvenation of old orchards of mango, sapota and guava. • Research on organic cultivation. • Standardization of fertigation and mulching. • Standardization of agro-techniques for commercial cultivation. • Use of PGRs for higher yield and quality. • Study on pollen storage technique and use of pollinizer varieties. • Introduction of new fruit crops. • Evaluation of minor fruit crops and standardization of production technology. • Standardization of different post-harvest techniques and value addition. • Production of quality planting material through conventional and tissue culture method.	material.
2.	High-tech floriculture	• Development/Introduction of new varieties for higher yield and processing. • Standardization of advance production technology for commercial cultivation. • Feasibility study of protected cultivation. • Use of PGRs for higher yield and quality. • Standardization of different post-harvest techniques and value addition. • Advance propagation techniques and production of planting material.	• Increase in productivity. • Supply of quality planting material. • Value added products.
3.	Research in vegetables and spices	• Standardization of production technology. • Feasibility study of protected cultivation. • Standardization of different post-	• Development of production and processing technologies. • Supply of quality seed and planting material.

Sr. No.	Goal	Approach	Performance measure
		harvest techniques and value addition. • Effect of PGRs on growth and yield. • Introduction of new crops. • Production of quality seed and planting material.	
5.2.6 Agricultural Engineering			
1.	Centre for remote sensing and geo-informatics in agriculture	• Guideline developments for assessing the types, extent and severity of moisture and nutrient stress for the major crops of the Saurashtra region. • Guideline developments for yield prediction at various crop growth stage for the major crops of the Saurashtra region. • Guideline developments for assessing the types, extent and severity of pest and insect attacks for the major crops of the Saurashtra region. • Assessment of the land, water and vegetation resources of the region. • Groundwater recharge planning based on topology and geological survey by remote sensing and GIS.	• Extension of real-time information on nutrient and moisture stress to end user and quick actions for the fertilizer applications and irrigation scheduling. • Increase in yield and reduction in cost. • Real spatial compensation to farmers for the insured crops. • Extension of real-time information on types, extent and severity of pest and insect attacks to end user and quick actions for the appropriate control measures. Reduction in unnecessary use of pesticides. • The information required for the planning and execution of land and water resources will be cheap and readily available on hand. • The cost reduction in the survey for planning and execution of the groundwater recharge planning.
2.	Water management	• Identification of most suitable in-situ rainwater harvesting practices. • Identification of most suitable rainwater harvesting-cum-groundwater recharge structures under different rainfall pattern and geological conditions. • Development of low-cost	• Crop production is secured against drought. • Decrease in soil erosion. • Augmentation of surface and groundwater resources in the region. • Increase in water and fertilizer use efficiency and reduction in consequences

Sr. No.	Goal	Approach	Performance measure
		automation in irrigation and fertigation. • Development of crop coefficient for the major crops of the region. • Assessment of crop water requirement in the changing climate. • Crop response to subsurface irrigation and water saving assessment. • Optimal deficit irrigation practices for the major crops. • Aquifer mapping of major river basins. • Development of different hydrological models suitable to local conditions. • Development of nanotechnology for the measurement of *in- situ* soil and water parameters. • Climate change impact assessment on water resources of the major river basins of the region. • Techno-economic strategies for the MIS with suitable mulching technology for the major crops. • Development of strategies for the unexploited groundwater and conjunctive use. • Development of location-specific groundwater recharge filter for runoff water. • Automation in canal regulation for the irrigation water supply.	problems. • Accurate stage irrigation water applications can be possible. • Saving of irrigation water. • Accurate planning of groundwater development and recharge planning. • Low-cost hydrological simulation for different river basins. • Easy monitoring of soil and water parameters and decision support system for resource inputs. • Decision support system for policy makers. • Increase in input use efficiency. • Decrease in waterlogged area and increase in crop production. • Improvements in groundwater quality. • Real-time supply to meet irrigation demand thereby increase in crop production and irrigated area.
3.	Management of coastal sodic and saline area	• Reclamation of waterlogged and coastal saline lands with physical as well as biological drainage measures. • Promotion of technologies related to multiple uses of water, on-farm water management.	• Increase in crop production • Increase in water productivity.
4.	Developing new implements or modifying the existing implements Farm	• Development of modern farm implements. • Modification of existing farm implements. • Development of modern implements with ergonomic and	• Increase in profit due to crop production. • Reduction in drudgery and accidental hazards in farms.

Sr. No.	Goal	Approach	Performance measure
		safety aspects.	
5.	mechanization with automation	• Establishing custom hiring centres for modern farm machinery along with Repair & Maintenance Cell at taluka and crop-specific region of the area. • Use of computers and electronics.	• Skill development at the village level and upliftment in the social status of farmers and farm labourers. • Reduction in farm labour requirement.
6.	Research on agro-processing	• Development and testing of processing technology and machinery.	• Value addition. • Increase in start ups/ incubation centres.
7.	Centre of excellence on post-harvest engineering	• Development of small-scale machines and post-harvest technology of important crops of Saurashtra.	• Increase in the level of crop processing • Reduction in storage losses.
8.	Value chain processing	• Development of low-cost machinery, storage structure and value-added products for processing the groundnut, onion and garlic.	• Assuring high returns to growers. • Reduction in the post-harvest losses. • Increase in the export of processed products
9.	Strengthening of research in energy for agriculture	• Establishment of advanced research centre on renewable energy for agriculture. • Development of technologies for sustainable energy in agriculture and effective utilization of renewable energy sources. • Development of waste/crop residues handling and management technologies for reduction of environmental degradation and bio-energy generation. • Establishment of testing facilities for renewable energy systems/PET. • Demonstration and popularization of RE technologies.	• Development and adoption of technology. • Reduction in conventional energy sources in agricultural/ agro-industries • Improvement in the quality of life of rural people.
10.	Strengthening of research in plasticulture engineering and technology	• Development of technologies on the application of plastics in agriculture. • Establishment of testing centre for plastics in agriculture.	• Increasein crop yield and quality • Reduction in input costs • Water saving • Increase in farmers' income
11.	Artificial intelligence,	• Establishment of High tech Research centre on AI, robotics	• Adoption of high technology for farmers to reduce

Sr. No.	Goal	Approach	Performance measure
	robotics and drone technology in agriculture	and drone technology in Agriculture. • Development of AI, robotics and drone technologies for agriculture.	drudgery in farming operations. • Precision obtained with saving of input materials.
5.2.7 Fisheries			
1.	Sustainable aquaculture production	• Utilization of coastal and inland areas suitable for aquaculture. • Development and adoption of advanced aquaculture production technology. • Establishment of hatcheries for commercially important marine fish, crustaceans and molluscs • Establishment of functional freshwater prawn hatchery. • Establishment of marine and freshwater ornamental fish breeding units. • Identification of alternative indigenous fish species for commercial aquaculture. • Specific Pathogen Free (SPF) broodstock and seed development. • Promotion of strict biosecurity measures. • Establishment and promotion of organic aquaculture/processing. • Improvement of indigenous fish varieties for fast growth and disease resistance through genetic improvement and biotechnological interventions. • Coverage of aquaculture farms under global certification programme. • Research on aquaculture feed plants. • Establishment of commercially viable seaweed aquaculture. • Research on aquaculture ancillary industries.	• Enhancement of overall aquaculture production and productivity. • Production and supply of commercially important seeds of marine fish, crustaceans and molluscs. • Production and supply of freshwater prawn seeds. • Production and supply of ornamental fish seeds. • Diversification of fish species in aquaculture. • Provision of SPF broodstock and seeds to lessen the aquatic disease risk in aquaculture. • Increase in overall aquaculture production through lessened soil and water contamination. • Increment in profit margin and global market acceptability of products. • Faster and accurate genetic selection of broodstock through SNP chip development to higher fish yield. • Reduction in feed input cost. • Generation of rural employment opportunities and upliftment in socio-economic status of rural coastal population.
2.	Bioprospecting of novel entities from marine resources	• Establishment of bioprospecting units to mine novel chemicals from marine seaweeds, sponges and other such resources.	• Production of novel drugs and pharmaceuticals from marine resources.

Sr. No.	Goal	Approach	Performance measure
3.	Disease diagnosis and control in aquaculture	• Establishment of aquatic disease diagnosis and control laboratories.	• Accurate disease diagnosis and timely control to prevent spreading it further, and lowering the disease risks in the region.
4.	Centre of Excellence on fish biotechnology	• Establishment of Centre of Excellence to promote application of biotechnological tools *viz.*, gene editing, transgenesis, cryo-preservation for enhancement of fish productivity. • Facilities for gene-mapping and genetic manipulation for improving quality and quantitative traits. • Initiation of research on nutrigenomics.	• Increase in fish production and minimizing losses.
5.	Aquatic biodiversity conservation and management	• Assessment of aquatic biodiversity through modern tools and techniques, and follow up measures for its conservation and management.	• Conservation and management of indigenous flora and fauna.
6.	Impact assessment of aquatic pollution and development of sustainable aquatic environment	• Periodical assessment of aquatic bodies for levels of pollution, its effects and development of mitigation measures.	• Generation of database of polluted water bodies, sources of pollution, and measures to improve the aquatic bodies.
7.	Development of improved fishing gears	• Designing of fishing gears *vis-à-vis* indigenous requirements of fishermen and sustainable capture fish production.	• Improvement in capture fish production with long term sustainability.
8.	Impact of climate change on fisheries	• Assessment of impact of climate change on marine and inland fisheries, mitigation measures and identification of suitable species.	• Sustain the fish productivity and ecosystem.
9.	Post-harvest and value addition	• Advanced technology to minimise post-harvest loss. • Establishment of fish processing units. • Development of value added fish products.	• Yield and profit making processed seafood. • Increase in export volume and foreign exchange.
5.2.8 Veterinary			
1.	Livestock improvement	• Conservation and improvement of animal genetic resources *viz.*,	• Increase in milk production. • Improvement in health of

Sr. No.	Goal	Approach	Performance measure
		Gir cattle, *Jaffrabadi* buffalos, *Kathiawari* horse and *Zalawadi* and *Gohilwadi* breeds of goats and wild ass. • Development of low-cost methods for storage and value addition in crop residues. • Identification and nutrition enhancement of unconventional feed resources. • Studies on bypass nutrients. • Clean milk production. • Nutritional manipulations for increasing bio-active peptides and omega-3 fatty acids of milk. • Generation of animal behavioural information for sustaining with environment/climate change and its effects on various performance traits.	livestock. • Improvement in socio-economic status of rural society.
2.	Establishment of advanced research centre on animal biotechnology	• Research for increasing yield and minimizing production risks through application of available biotechnologies *viz.*, cryo-preservation of sperm and ova, embryo-transfer technology, semen sexing, nano therapies etc. • Facilities for gene-mapping and genetic manipulation for improving the quality and quantitative traits. • Research for improving efficiency of rumen microbes. • Establishment of bio-safety lab. level III & IV.	• Enhanced total productivity, reduced mortality and enhanced productive life. • Application of MOET (Multiple Ovulation and Embryo Transfer) in the field. • Increased use of pre-biotics and pro-biotics in the animal feed.
3.	Establishment of regional animal disease diagnostic laboratory	• Establishment of regional laboratory facilities for full-fledged clinical diagnosis of diseases of livestock and wild animals. • Use of ITK in prevention and control of diseases and parasites.	• Effective diagnosis for prevention and control of diseases in livestock and wild animals.
4.	Conservation and characterization of *Kathiawari* horse.	• Establishment of *Kathiawari* horse research institute. • Disease surveillance and organization of health camps on regular basis. • Feeding technologies for	• Improvement in health and nutritional status of *Kathiawari* horse.

Sr. No.	Goal	Approach	Performance measure
		Kathiawari horses to overcome nutritional deficiencies.	
5.	Wildlife healthcare	• Standardization of haemato-biochemical parameters of wild animals. • Clinical expertise services for wildlife healthcare, disease diagnosis and therapeutic management. • Prevalence of gastrointestinal parasites in wild animals. • Probable infectious causative agent determination and their response to therapy.	• Baseline data for haemato-biochemical parameters of wild animals. • Health improvement.
5.2.9 Social Sciences			
1.	Studies on farmers' income and farm profitability	• Continuous analysis on farm harvest prices, cost of cultivation particulars and export trends of all major agricultural, horticultural crops and livestock products. • Techno-economic feasibility on processing and value addition. • Studies on commodity prospects and marketing efficiency. • Studies related to export performance and competitiveness. • Documenting the performance of various econometric and statistic models in the assessment of income and price data. • Documentation of cost-reduction technologies followed by the farmers including ITKs.	• Increased income and farm profitability. • Scale of processing and value addition. • Policy suggestions to overcome Technical Barriers to Trade (TBT). • Developed marketing models. • Increased technical, economic, allocative and resource-use efficiencies. • Documentation of spatio-temporal performance of banking/ credit institutions using models like CAMEL.
2.	Yield gap analysis of crops in agriculture and horticulture	• Periodic studies on technological & extension yield gaps. • Mapping the adoption of improved cultivars and management practices at farmers' level.	• Preparation of a yield gap atlas for Saurashtra. • Spatial and temporal analysis of yield gaps.
3.	Research on Trade and Intellectual Property Rights	• Involvement of social sciences in research prioritization, technology development, targeting and dissemination. • Fostering inter-institutional collaboration at regional,	• Strengthening knowledge and understanding of IPRs for policy prescriptions. • Exploring the interaction between ITKs and IPRs.

Sr. No.	Goal	Approach	Performance measure
		national and international levels for research, training & development.	• Commercialization of IPRs for the benefit of farming community.
4.	Enabling knowledge-intensive agriculture	• Devising economically-viable, socially-acceptable & environment-friendly policy options for science-led agricultural growth. • Strategic policy research and human resource development. • Conducting programmes for entrepreneurship development. • Studies on land-use issues, labour issues, environmental issues and water-use issues.	• Generation of evidence-based and policy-relevant knowledge. • Location-specific agri-based entrepreneurship models. • Policy recommendations to resolve the issues.
5.	Transfer of technology	• Developing diffusion models and e-applications for faster and widespread ToT. • Develop Door Step System and expert system for transfer of technology.	• Extent and pace of adoption. • Success stories.
6.	Exploring new frontiers in social science	• Research on experimental / behavioural economics. • Big data analytics on the latest developments of markets, marketing, trade and technology. • Randomized Control Trials (RCTs) for impact assessment. • Evaluation studies on artificial intelligence and robotics in agriculture.	• Adoption of technologies. • Precise and real time decisions.
7.	Sustainable resource use and economic dynamics.	• Studying the interaction between resource dynamics and social dynamics using advanced models. • Survey of availability and use of natural resources. • Accounting the implications of climate variability on major crops. • Mapping the alternatives that can be used by the farmers to combat the implications of climate change.	• Policy options for optimal use of resources. • Quantification of natural resources. • Determination of shadow prices of agricultural production and exports. • Increase in total factor productivity.
8.	Best-fit statistical forecasting in field experiments, weather parameters	• Validation of best-fit statistical models. • Meta-analysis and meta-forecasting studies.	• Improved precision in data handling and analysis. • Better accuracy in forecasting.

Sr. No.	Goal	Approach	Performance measure
9.	Agricultural commodity price forecasting	• Validation of real-time, dynamic and quantitative forecasts in agricultural markets. • Organic integration of ICT and econometric analysis. • Application of machine learning concepts.	• Models for forecasting market price dynamics. • Improved scientific decisionmaking for farmers and market regulation.
10.	Adoption of research and feedbackfrom stakeholders	• Studies on adoption of research technologies. • Collection of feedback from stakeholders. • Communication of technological constraints and feedbacks to scientists.	• Scale of adoption. • Technology refinement.
5.3 EXTENSION EDUCATION			
1.	Transfer of technology	• Conducting Front Line Demonstrations (FLDs) and On Farm Trials. • Publishing agricultural technologies on University website. • Door step system and expert system for transfer of technology. • Organizing workshop, field day, farmers' meeting, *etc.* for farmers. • Knowledge updatation programmes for line departments, ATMA, NGOs, etc. • Regular publication of technologies in print media. • Telecast of Agricultural technology in mass/social media. • Tapping the potential of high-tech devices and virtual learning models.	• Level of adoption • Success stories • FLDs and OFTs conducted. • Publications. • Extension programmes organised. • Radio/TV/Mass media programmes telecasted.
2.	Training programmes and certificate courses	• Organizing on-campus and off-campus trainings. • Training for line departments. • Exposure visits for farmers. • Vocational training programmes • Model/Advance/Specialized trainings. • Sensitization and orientation workshops. • Certificate courses on baking,	• Training programmes organized. • Impact of training • Number of beneficiaries. • Self-employment and entrepreneurs.

Sr. No.	Goal	Approach	Performance measure
		mali, Agro-ITI-based courses, input dealers *etc.* • Initiating new certificate course on Agril. Journalism and Mass media communication.	
3.	Advisory support to farmers	• Help line, Kisan Call Centre, telephone, mobile. • Correspondence, print media, mass media, social media. • Problem diagnosis and face to face advice. • Analysis of soil/plant/water samples and advice accordingly. • Scientist field/diagnostic visit. • Mobile plant/animal clinic van. • Farmers group discussion at village level. • Video conferencing and live-in TV programmes. • Expert systems and kiosks.	• Guidance provided. • Problems diagnosed. • Field visits. • Number of beneficiaries • Communication programmes. • Farmers meetings.
4.	Agricultural fairs and exhibitions	• Organizing agricultural fairs and exhibitions. • Conducting *Krushi Mahotsava* for horizontal transfer of technologies. • Establishment and modernization of agricultural museum. • Celebration of crop production weeks. • Celebration of agriculture related national and international events. • Felicitation of progressive farmers. • Documentation of innovative farmers and success stories. • Formation of farmers interest groups. • Creating mobile exhibition facility.	• Fairs and exhibitions. • Number of footfalls. • Events celebrated. • Success stories generated. • Farmers honoured.
5.	Publication of agriculture literature	• Publishing folders, pamphlets, brochures, bulletins, booklets, diaries, books, *etc.* in vernacular language for stakeholders. • Launching of farm magazine. • Recording technology videos.	• Number of publications. • Literature sold/distributed.

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6.0 Strengthening linkages :

The existing formal and informal linkages with the State Agricultural Universities, line departments, national institutes under Indian Council of Agricultural Research, Department of Biotechnology, Council of Scientific and Industrial Research, international institutes like International Crops Research Institute for the Semi-Arid Tropics, International Maize and Wheat Improvement Center, Government organizations like Gujarat State Seed Corporation, Gujarat State Seed Certification Agency, Gujarat State Agro-Industrial Corporation, Gujarat State Sardar Sarovar Narmada Nigam, Gujarat State Biotechnology Mission, Gujarat State Forest Department etc. would be further strengthened for better cooperation in various activities. Partnership with private seed companies/ manufacturers, NGOs, Farmers' organizations, Marketing institutions, etc. would be stepped up for target based research and dissemination of new agricultural technologies. The University has also developed linkages under private sector for testing of agro-chemicals, varieties and for production and marketing of vegetable varieties developed by the scientists.

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7.0 Epilogue:

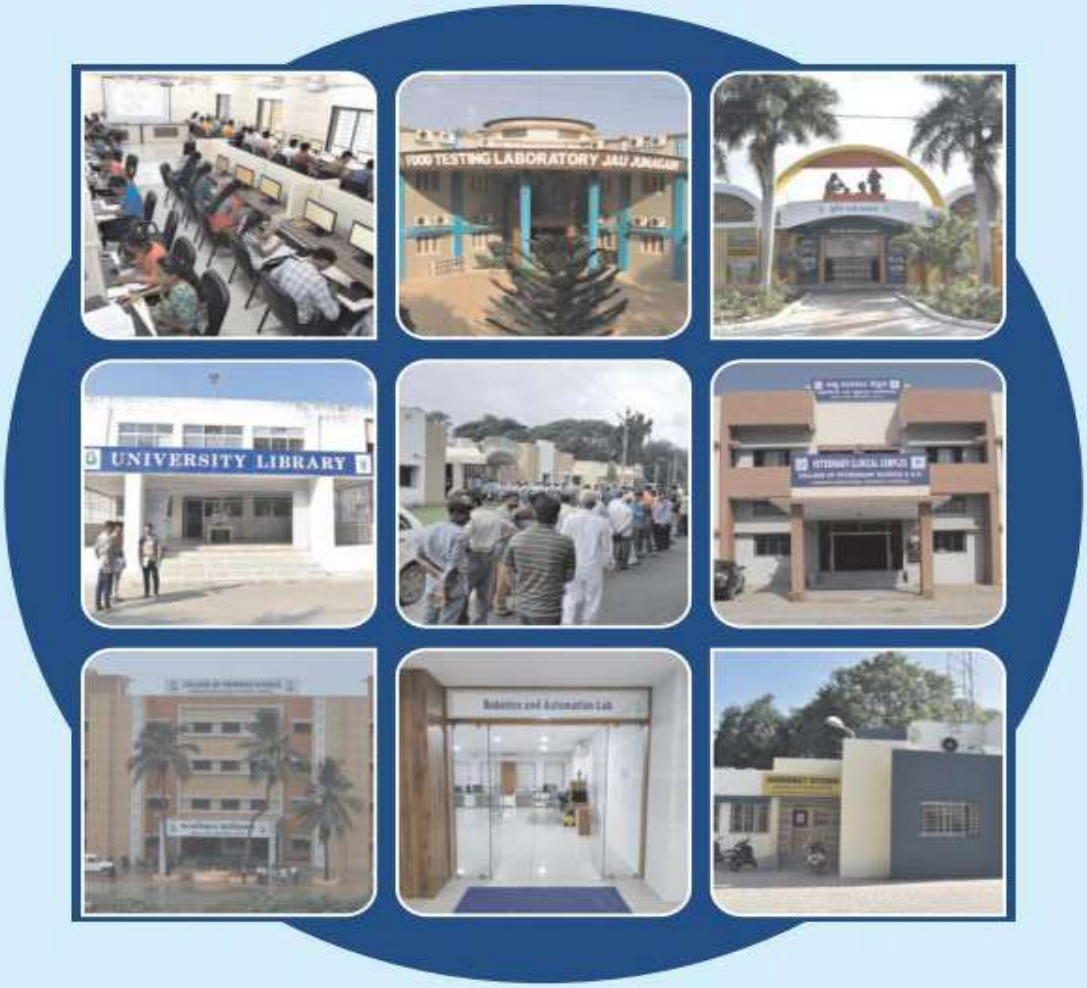
Junagadh Agricultural University is committed to bring a need-based and technology-led revolution in Gujarat state as well as the nation to meet the challenges of ever rising demand for food, improving livelihood of farmers and for ensuring sustainable agriculture. We envision that innovations in agriculture would transform agriculture into a vibrant and competitive environment by harnessing untapped opportunities in domestic and global markets. The University believes that agricultural research would augment farmers' income, generate employment opportunities, conserve natural resources, promote exports and increase value addition for higher and comprehensive agricultural growth. Planned, systematic and concerted efforts would be developed to promote a vibrant academic and research

culture in JAU that would be more sensitive to the needs of the farming community, especially of the smallholders and of the poor living in the backward, fragile, rural and marginal areas. Intensive endeavours will be made to emphasize agro-eco region specific research and finding solutions to local problems through the existing network. In the years to come, climate change and climate variability will certainly drive the research programme of the University in form and substance. Research related to the application of robotics, artificial intelligence and drone technology in agriculture are also the need of the hour.

JAU, thus, will build upon and expand its existing relationships within organization as well as with regional, national and international organizations, offering expansion towards regular and specific teaching, research, systemic change, and policy development activities with a clear focus on supporting young students to develop innovative ideas on important issues of agriculture. In a nutshell,the VISION 2050 activities will address many sensitive issues of economic, social and climatic parameters of Saurashtra region. More specifically, the University will get engaged in the development of shared curricula and learning exchanges for professionals of other organizations, thereby, addressing issues related to multiple inclusions and socio-economic developments. This hiked environment will provide the students, faculty and scientists, a platform to understand the intersection of on ground knowledge, research, practice and the application of evidence-based strategies for development of overall agricultural sector.

JAU will march ahead with renewed zeal and achieve new milestones not only in the country but also in global agricultural front. The University is committed to play pivotal role in teaching, research and extension education for sustained development of agriculture and allied sectors. In this context, JAU is absolutely devoted in realizing the new frontiers and using them to develop excellent human resource, innovative technologies and their dissemination so as to proficiently serve the farming community of the state and the country. The university will develop mechanism to regularly monitor the changes in agriculture scenario at state level, and the strategies to respond to the changes for the benefit of the farmers. Efforts will be made to maintain a culture of responsibility, accountability and integrity in agriculture science at the University. This way, JAU will keep the needs of contemporary and future agrarian sector in view to envisage the strategies and programmes, and is determined to boost the quality of education, research and extension in the modern, fast galloping era of radical transformation in science and industry. ❐

Vision 2050



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Junagadh Agricultural University
Junagadh - 362 001
(Gujarat), India
www.jau.in