

RESEARCH



Chapter - IV



4.1 Agricultural Research Council

The Agricultural Research Council was constituted according to the provision of the Gujarat Agricultural Universities Act 2004 in exercise of the power vested under section 62(1) in pursuance of

section 17(5). Dr. V. P. Chovatia monitored and guided the research activities during the reporting period. 14th Research Council meeting was organized on January 12, 2017 for approval of new research programs and research activities during the year.

Table 4.1: Members of 14th Agricultural Research Council

No.	Name	Designation
1	Dr. A. R. Pathak	Vice Chancellor (Chairman)
2	Dr. V. P. Chovatia	Director of Research & Dean PG Studies (Secretary)
3	Dr. R. R. Shah	Director of Agriculture, Government of Gujarat, Gandhinagar
4	Dr. R. A. Sherasia	Director of Horticulture, Government of Gujarat, Gandhinagar
5	Dr. Hita Patel	Director of Animal Husbandry, Govt. of Gujarat, Gandhinagar
6	Dr. A. M. Parakhia	Director of Extension Education
7	Dr. I. U. Dhruj	Associate Director of Research
8	Dr. A. V. Barad	Dean, Agriculture Faculty
9	Dr. N. K. Gontia	Dean, Agricultural Engineering Faculty
10	Dr. A. Y. Desai	Dean, Fisheries Science Faculty
11	Dr. P. H. Tank	Dean, Veterinary Science & Animal Husbandry Faculty
12	Dr. K. A. Khunt	Dean, Post Graduate Institute of Agribusiness Management
13	Dr. M. A. Vaddoria	Research Scientist and Convener, Crop Improvement AGRESCO Subcommittee
14	Dr. K. B. Polara	Prof. and Convener, Crop Production AGRESCO Subcommittee
15	Dr. V. V. Rajani	Research Scientist and Convener, Plant Protection AGRESCO Subcommittee
16	Dr. R. S. Chovatia	Professor & Head and Convener, Horticulture & Agro Forestry AGRESCO Subcommittee
17	Dr. R. Yadav	Professor & Head and Convener, Agricultural Engineering AGRESCO Subcommittee
18	Dr. V. J. Bhatia	Professor & Head and Convener, Basic Science AGRESCO Subcommittee
19	Dr. S. M. Upadhyay	Professor & Head and Convener, Social Science AGRESCO Subcommittee
20	Dr. K. S. Murty	Professor & Head and Convener, Animal Science & Fisheries AGRESCO Subcommittee
21	Dr. K. L. Dobaria	Research Scientist (Groundnut)
22	Dr. B. A. Golakia	Professor & Head (Biotechnology)
23	Dr. H. D. Rank	Professor & Head (Soil & Water Engg.)
24	Dr. K. L. Mathew	Professor & Head (Fisheries)
25	Dr. J. S. Patel	Professor & Head (Medicine)
26	Dr. P.S. Bharodia	Retired Research Scientist (Plant Breeding)
27	Prof. J. B. Savani	Retired Professor (Agricultural Engineering)
28	Shri Sandipbhai S. Thumar	Progressive Farmer, At: Vadal, Ta. & District: Junagadh



14th Research Council Meeting of JAU organized under the chairmanship of Dr. A. R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh

4.2 Planning and Monitoring

Monitoring

The monthly and quarterly progress reports were obtained from the concerned heads of the schemes which were compiled and submitted to the Government quarterly. The problems of the scheme were solved satisfactorily by discussion between scientists and the Director of Research in two meetings held during the month of December-2016 and February-2017 for evaluation of expenditure of planned schemes and reallocation of the funds, *etc.*

State Programs

Monitoring of research works is done through a set system in the University. The University jurisdiction comprises of four agro-climatic zones *viz.* North Saurashtra, South Saurashtra, partially North West and Bhal & Coastal agro-climatic zones. The authorities of Directorate of Research at Junagadh and Dry Farming Research Station, Targhadia coordinate, monitor and supervise the

implementation of research programs of various schemes in the respective zones. The monitoring is carried out directly on field as well as through presentation of findings in various committees *viz.* 1) Zonal Research and Extension Advisory Committee (two zones) 2) Agricultural Research Subcommittee (eight discipline wise) 3) Joint Agricultural Research Subcommittee (one for all disciplines) and 4) Combined Joint Agricultural Research Subcommittee (one for all four State Agricultural Universities). All the committee meetings are held regularly in every year to evaluate the progress of research works, research findings of each experiment, examination and scrutiny of new research programs, examination and refining of findings to be delivered in the form of recommendations. The presentation of research results as well as reports for all research stations is mandatory. The reports are prepared separately for various committees.



Table 4.2.1: List of plan and non-plan research projects functioning in the university

(A) Plan Scheme (Sponsored by Government of Gujarat State)

Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
1	12002-00	Strengthening of research in millet	1986	Pearl millet Research Station, Jamnagar
2	12006-00	Strengthening of research in sorghum	1981	Cotton Res. Station, Kukada
3	12007-00	Strengthening of research in pulses	1989	Pulse Res. Station, Junagadh
4	12008-00	Strengthening of research in oilseed (Groundnut)	1986	Oilseed Research Station, Junagadh & Manavadar
5	12009-00	To establish a centre of excellence for cotton research	1986	Cotton Res. Stat., Junagadh and ARS, Amreli & Ratia
6	12013-00	Strengthening of scheme of vegetable research at Junagadh	1995	Vegetable Research Station, Junagadh
7	12027-00	Scheme for management of salt affected soil & poor quality of under-ground water	1988	Dept. of Agriculture Chemistry & Soil Science, Junagadh
8	12044-01	Research in bio-technology	1995	Dept. of Biochem., Junagadh
9	12078-00	Strengthening of research in dry-farming	1979	DFRS, Targhadia & Ratia
10	12092-00	Strengthening of tissue culture research & development at all campuses	1990	Dept. of Plant Breeding & Genetics, Junagadh
11	12094-00	Research for integrated pest mgmt. in fruit crops	1997	Dept. of Entomology, Junagadh
12	12095-00	Strengthening of horti. res. & devp. activities	1997	Dept. of Horticulture, Junagadh
13	12096-00	Res. on micro irri. system in Saurashtra region	1997	Dept. of Agronomy, Junagadh
14	12131-00	Research on eco-friendly biological fertilizer	1997	Dept. of Pl. Patho., Junagadh
15	12712-06	Creation of additional posts as per Supreme court orders	1991	CBF, CoA, CAET, Junagadh & CoF, Veraval
16	12712-5B	Campus development program (on campus)	2004	Office of Director of Research, Junagadh
17	12903-00	Establishing of organic farming cell at Junagadh	2000	Dept. of Agronomy, Junagadh
18	12905-00	Proposal for research on watershed management	2000	DFRS, Targhadia; GRS, Dhari & Dept. of SWE, CAET, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
19	12907-00	Strengthening of agro-meteorology at JAU	2000	Dept. of Agronomy, Junagadh
20	12930-00	Establishment of new sub-center for research on cumin	1998	Agri. School, Halwad
21	12931-00	Establishment of new research centre on onion crop	2003	Vegetable Research Station, Junagadh &FRS, Mahuva
22	12573-00	Research on tillage technology	2006	Dept. of Agronomy, Junagadh
23	12574-00	Research on rejuvenation of degraded coastal agro-eco systems of Saurashtra	2006	Research Training & Testing Centre, Junagadh
24	12575-00	Strengthening research in sesamum	2006	Agril. Research Station, Amreli
25	12101-00	Centre of excellence on soil and water management	2006	RTTC, Junagadh; DFRS, Targhadia; ARS (FC), Mahuva & FRS, Mangrol
26	12576-00	Research on post-harvest technology of important crops of Saurashtra	2006	Dept. of Processing & Food Engg., CAET, Junagadh
27	12582-00	Strengthening of research on genetically modified cotton	2009	Cotton Research Station, Junagadh
28	12583-00	Strengthening of wheat research	2009	Wheat Res. Station, Junagadh
29	12584-00	Strengthening research on castor	2009	Oilseed Res. Stat., Junagadh
30	12585-00	Strengthening research in sugarcane	2009	Sugarcane Res. Stat., Kodinar
31	12586-00	Strengthening of research in plantation and fruit crops at A.R.S.(Fruit crops)	2009	Fruit Research Station, Mahuva
32	12587-00	Conservation of plant biodiversity	2009	Dept. of Genetics &Plant Breeding, Junagadh
33	12588-00	Development of arid and semi-arid fruit crops	2009	Dept. of Horticulture, Junagadh
34	12590-00	Establishment of Bt cotton research centre at Surendranagar district	2011	Cotton Research Station, Kukada
35	12014-00	Establishment of spices res. centre at Junagadh	2011	Vegetable Res. Stat., Junagadh
36	12015-00	Establishment of bio-fertilizer unit at Junagadh	2011	Dept. of Plant Patho., Junagadh
37	12018-00	Establishment of research centre on onion at Talaja Dist.: Bhavnagar	2011	Agriculture Research Station, Talaja



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
38	12019-00	Strengthening of dry farming research at Jam Khambhaliya	2012	Dry Farming Research Station, JamKhambhaliya
39	12020-00	Strengthening of dry farming research at Vallbhipur	2012	DFRS, JamKhambhaliya and Vallbhipur
40	12021-00	Establishment of mango res. project at Talala	2012	Dept. of Horticulture, Junagadh
41	12022-00	Project on mega seed for quality seed production & distribution	2012	Dept. of Seed Science & Tech., Junagadh
42	12023-00	Micronutrients and sulphur research in soils and plants in Saurashtra region	2012	Dept. of Ag. Chemistry & Soil Science Junagadh
43	12024-00	Centre of remote sensing and geoinformatics in agriculture	2012	Dept. of Soil & Water Engg., CAET, Junagadh
44	12025-00	Recycling of organic waste for sustainable soil productivity under dry land agri. at Targhadia	2012	Dry Farming Research Station, Targhadia
45	12026-00	Project for res. on forage crop prod. at Dhari	2012	Grassland Res. Station, Dhari
46	12028-00	Aflatoxin and its management in groundnut in Saurashtra region of Gujarat	2013	Oilseed Research Station, Junagadh
47	12029-00	Molecular mapping of important traits and their transfer through marker assisted selection(MAS)in groundnut and cotton	2013	Dept. of Biochemistry, Junagadh
48	12030-00	Studies on effect of climate change on fruit crops of Saurashtra region	2013	Dept. of Horticulture, Junagadh
49	12303-05	Establishment of Gir cattle & Jaffrabadi buffaloes	1996	Cattle Breeding Farm, Junagadh
50	12953-00	Strengthening of livestock & veterinary component	2002	Cattle Breeding Farm, Junagadh
51	12303-14	Integrated farming system (Integrated farming combining crop livestock bio resources)	2009	Cattle Breeding Farm, Junagadh
52	12303-15	Establishment of bull mother farm of Gir cattle & Jaffrabadi buffaloes	2011	Cattle Breeding Farm, Junagadh
53	12950-00	Establishment and devp. of res. in fisheries	2000	Fisheries Res. Station, Okha
54	12577-00	Value added products from fish / shelifish	2006	College of Fisheries, Veraval
55	12578-00	Establishment of inland fishery research centre	2006	Inland Fisheries Research Station, Junagadh
56	12579-00	Establishment of pearl oyster hatchery	2009	Fisheries Res. Station, Sikka



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
57	12581-00	Feasibility of mass culture of marine red algae <i>Kappaphycus alvarezii</i> (Schimitz) on the Saurashtra region at west coast of India	2009	Fisheries Research Station, Okha
58	12016-00	Establishment of aqua-based research and training centre in coastal Saurashtra at Mahuva	2011	Agricultural Research Station (FC), Mahuva
59	12031-00	Crop improvement in papaya at Junagadh	2014	Dept. of Horti., Junagadh
60	12032-00	Integrated pest management in seed spices at Junagadh	2014	Dept. of Entomology, Junagadh
61	12033-00	Evaluation of pharmacological activity of indigenous medicinal plants of Saurashtra region	2014	College of Veterinary Science & Animal Husbandry, Junagadh
62	12034-00	Identification & documentation of marine fish biodiversity using mitochondrial DNA bar coding at Veraval	2014	College of Fisheries, Veraval

(B) Non Plan Scheme (Sponsored by Government of Gujarat State)

Sr. No.	Budget Head	Name of Program	Sanction Year	Location
1	3226	Scheme of design experiment	1980	Dept. of Agril. Statistics, Junagadh
2	5002	Scheme for research in bajra	1985	Pearl millet Res. Stat., Jamnagar Agricultural Res. Station, Talaja
3	5004	Scheme for research in wheat	1995	Wheat Research Station, Junagadh Fruit Research Station, Mangrol
4	5006	Scheme for research in sorghum	2011	Cotton Research Station, Kukada
5	5007	Project for the research in pulses	1975	Pulse Research Station Junagadh
6	5008	Scheme for oilseed research	1962	Oilseeds Res. Station, Junagadh
			1973	Agril. Research Station, Amreli
			1985	Pearl millet Res. Stat., Jamnagar
			1979	Sugarcane Res. Station, Kodinar
			1979	Oilseed Res. Station, Manavdar
7	5009	Scheme for strengthening of research in cotton investigation of fiber crops other than cotton, development of remie fiber.	1985	Agril. Research Station, Amreli
			1985	Cotton Research Station, Khapat
			2002	Cotton Research Station, Junagadh
8	5011	Scheme for research in sugarcane	1971	Sugarcane Res. Station, Kodinar



Sr. No.	Budget Head	Name of Program	Sanction Year	Location
9	5012	Scheme for research in grasses forage	1985	Grassland Research Station, Dhari
10	5013	Strengthening of research in vegetable (Tomato)	1962	Vegetable Research Station, Junagadh
11	5014	Scheme for research and improvement in fruit crops	1961-62	Fruit Research Station, Mangrol
				Agril. Res. Station(FC), Mahuva
				Dept. of Horticulture, Junagadh
12	5018	Scheme for res. studies in agri. economics	1972	Dep. of Agril. Eco., Junagadh
13	5020	Scheme for research in agriculture chemistry & soil science	1972	Dept. of Agril. Chemistry & Soil Science, JAU, Junagadh
14	5025	Project for the research in agronomy and crop husbandry	2005	Dept. of Agronomy, Junagadh
15	5026	Project for the research in pest control and other entomological aspect	1960	Dept. of Entomology, Junagadh
16	5042	Strengthening of dry farming research station	1965	Dry Farming Res. Station, Ratia
			1979	Dry Farming Res. Stat., Targhadia
			1967	DFRS, Jam-Khambhalia
			1964	Dry Farming Res. Stat., Vallbhipur
			2011	Cotton Res. Stat., JAU, Kukada
			1975	Grass Land &ARS, Dhari
			1947-48	Megaseed Project, Sagdividi
			1995	Cotton Res. Stat., JAU, Khapat
1967	Dept. of Agronomy, Junagadh			
17	5044	Project for the research in plant diseases and other pathological aspect	1985-86	Department. of Plant Pathology, Junagadh
18	5046-A	Study of biology investigation & control of weed control, botanical garden and cytogenesis	1969	Dept. of Genetics & Plant Breeding, Junagadh
	B			
	C			
19	5073	Research in agricultural engineering	1962-63	RTTC, Junagadh
20	5075	Establishment of seed technology cell	1981	Office of the Dir. of Res., Junagadh
21	7082-A	National agriculture research project	1987	Oilseed Research Station, Junagadh
	7082-B	National agriculture research project	1995	DFRS, Jam- Khambhalia
	7082-B	National agriculture research project	1988	Pearl millet Res. Station, Jamnagar
	7082-C	National agriculture research project	1982	Grassland Research Station, Dhari



Sr. No.	Budget Head	Name of Program	Sanction Year	Location
22	9091	NARP Scheme phase-II	1989	Cattle Breeding Farm, Junagadh
23	9091-9	NARP Scheme phase-II	1989	Cattle Breeding Farm, Zonpur
24	5353	Livestock research station	1978	Cattle Breeding Farm, Junagadh
25	7253	Strengthening research in veterinary science & animal husbandry	1986	
26	5302	State farm for Gir and Kankarej cattle	1949	

Zonal Research Extension Advisory Committee (ZREAC)

This committee is functioning at Zonal level of South Saurashtra & North Saurashtra agro-climatic zones and two meetings are organized in the year *viz.*, *kharif* and *rabi* summer. The research programs / works carried out in different schemes/projects are presented by scientists in the meeting. The power point presentations are made in the house for thorough discussion and refinement of each ongoing project. In this meeting scientists from different disciplines as well as officers from line departments are participating and debating on the results of the projects as well as suggest improvement in new technical programs for future research work. The

officers from the line departments are also presenting feedback as well as overall agriculture situations in their regions. They also suggest the inputs for new area of research. It is the multidisciplinary task to evaluate the research results of different disciplines.

During the year 2016-17, four meetings of ZREAC were organized; two each at Junagadh and Targhadia. In both ZREAC meeting, four varieties, 48 farmers' recommendations, 18 scientific recommendations and 100 new technical programs were approved (Table 4.2.2). The feedbacks as well as suggestions were also received from the officers of line departments.



**Table 4.2.2 Zonal Research Extension Advisory Committee (ZREAC) meeting**

Meeting	Place	Date	No. of Participants	No. Of Recommendations approved		New Technical Programs
				Farmers'	Scientific	
North Saurashtra Agro-climatic Zones (Zone - VI)						
25 th ZREAC (Rabi-summer)	Targhadia	October 17, 2016	60	01	-	01
26 th ZREAC (kharif)	Targhadia	February 07, 2017	62	1*+8	01	07
South Saurashtra Agro-climatic Zones (Zone - VI)						
25 th ZREAC (Rabi-summer)	Junagadh	October 07-08, 2016	136	1*+14	10	33
26 th ZREAC (kharif)	Junagadh	January 17-18, 2017	140	2*+25	07	59
Total				4*+48	18	100

*Variety released

Agricultural Research Sub Committee (AGRESCO - Discipline wise)

There are eight sub-committees of research functioning in the university to manage the research activities mentioned herein:

Table 4.2.3 Agricultural Research Sub Committees

Sub Committee	Subject areas of Research
Crop Improvement	Development of variety and maintenance of germplasm of mandate crops
Crop Production	Agronomy & Soil Science, Weed Control
Plant Protection	Entomology & Plant Pathology
Horticulture & Agro Forestry	Fruits, Vegetables, Flowers and Spices
Agricultural Engineering	Soil & Water Engineering, Farm Machinery & Power, Renewable Energy & Rural Engineering, Processing & Food Engineering and Research, Training & Testing
Fisheries Science & Animal Science	Fisheries Resource Management, Post-harvest Technology, Aquatic Environment, Aquaculture, Fishery Hydrology and Fishery Engineering Breeding, Animal Nutrition, Livestock Production & Management, Anatomy, Medicine & Surgery, Animal Genetics શાંલિલ.
Basic Science	Biochemistry, Biotechnology, Plant Physiology and Seed Technology
Social Science	Agricultural Economics, Agricultural Extension Education, Agricultural Engineering Extension Education, animal Husbandry Extension Education, Agricultural Statistics and Agribusiness Management



The members of the committees are senior scientists of the university working in various departments/ projects, subjects matter specialists and representatives of state line departments. The conveners of all committees are nominated by the Director of Research for two years to organize the meeting and also issuing the proceedings. The meeting of all committees is held annually to discuss and to evaluate the research results. The members also critically discuss the new technical programs as well as the recommendations for farmers and scientific community. The suggestions made in the meetings are incorporated in the reports and accordingly improved recommendations and new programmes. The

committee is consisting of senior scientists as a member. Hence, the proposals and programs pertaining to the various disciplines are discussed critically. The conveners of various sub committees present the proceedings in the Joint AGRESKO meeting.

The Agricultural Research Sub Committees were held during February to March 2017 at Junagadh. Six new crop varieties, 43 farmers' recommendations, 24 scientific recommendations and 115 new technical programs were approved. The reports of the work carried out at various research schemes of the university were also presented and approved.



Agril. Engg. & Basic Science AGRESKO Sub-committee Meeting



Crop Improvement & Crop Production AGRESKO Sub-committee Meeting

Table 4.2.4 Various AGRESKO (Discipline wise) meetings organized

Sub Committee	Date	No. of Participant	No. of Recommendations		New Technical Programs	On-going Research Projects
			Farmers	Scientific		
Social Science	February 14-15, 2017	50	-	02	13	12
Animal Science		75	02	07	07	15
Fisheries Science		05	01	07	22	
Agricultural Engineering	February 17-18, 2017	40	07	01	13	30
Basic Science		37	02	02	14	35
Horticulture & Agro Forestry	February 21-22, 2017	31	09	-	09	18
Plant Protection		46	04	08	29	262
Crop Production	March	62	14	03	22	130
Crop Improvement	9-10, 2017	51	06*	-	01	309
Total		392	06*+43	24	115	833

*Variety released



Joint Agricultural Research Sub Committee (Joint AGRESKO)

Joint Agricultural Research Sub Committee meeting is held annually to discuss research proposals and results. The committee finalizes the recommendations and new technical programs to be undertaken in various disciplines. This committee comprises of the Director of Research, Associate Director of Research, the senior scientists of various disciplines, representatives of line departments *etc.* finalize the programs. The conveners of various AGRESKO sub committee present the findings of their respective committees for approval. This committee meeting is presided over by the Hon'ble Vice Chancellor. Joint AGRESKO will finalize the recommendations and new technical programs for research, which is to be presented in the ensuing 13th Combined Joint AGRESKO of State Agricultural Universities.



The 13th Joint AGRESKO meeting was held at College of Agricultural Engineering & Technology, JAU, Junagadh on March 21, 2017 under the chairmanship of Dr. A. R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh. All AGRESKO conveners of various committees presented their reports and approved. Four new crop varieties, 42 farmers' recommendations, 26 scientific recommendations and 118 new technical programs were approved in the meeting.

Combined Joint Agricultural Research Sub Committee (One for four State Agricultural Universities)

This is the apex body to finalize the research recommendations at state level as well as the new technical programs. The meeting is held at the venues in the rotational mode. The members of this committee include Hon'ble Vice Chancellor, Director of Research, Director of Extension Education, Associate Director of Research, Conveners of various AGRESKO subcommittees and senior scientists of various disciplines of all State Agricultural Universities. Director of Agriculture, Director of Horticulture and Director of Animal Husbandry are the members of the committee. Hon'ble Minister of Agriculture & Cooperation, Govt. of Gujarat also attends the meeting. Separate sessions are organized discipline-wise, in which conveners of various AGRESKO subcommittee present the reports of their respective universities. In the concluding session, the conveners from each subcommittee present the final report of research in the meeting. The output of research in the form of recommendations/ technologies is published in the form of proceedings and supplied to the all concerned for implementation.

The 13th Combined Joint meeting of the Agricultural Research Council (AGRESKO) of State Agricultural Universities of Gujarat and Kamdhenu University was held at Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during 05-07 April, 2017 under the Chairmanship of Dr. A. A. Patel, Hon'ble Vice Chancellor, SDAU, Sardarkrushinagar. Shri Sanjay Prasad, Principal Secretary (Agri.), Government of Gujarat remains present as chief guest. Dr. A.R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh and Dr. N.C. Patel, Hon. Vice Chancellor, AAU, Anand were the guest of honor and Dr. R. A. Sherashiya, Director of Horticulture, Government of Gujarat was the special guest. Besides, Dr. G.R. Patel, Director of Extension Education, NAU, Navsari & Directors of Research of all SAUs, Principals and Deans of various faculties of



SAUs, officers from Line Department of Gujarat state, the Associate Directors of Research, the conveners of different sub-committees of SAUs, the senior scientists/professors of SAUs attended the meeting.



Dr. A.R. Pathak, Hon. Vice Chancellor, JAU, Junagadh expressed his views on agriculture research and need for investment in agriculture research which has more returns than any other enterprise. He added that the challenges and problems faced by farmers should be at the focal point for undertaking research

programs. Considering the difficulty in unbiased biosafety testing in Genetically Modified crops, he recommended the use of Marker Assisted Selection as an option for GM crops, which is otherwise less exploited in SAUs. Further, he emphasized the need for undertaking research in frontier areas of nanotechnology, value addition in fruit crops, drip irrigation; especially in mango orchards, diversification in mango varieties and supply of organic inputs including seeds and proper demonstrations of organic farming to the farmers for the success of organic farming.

In the 13th Combined Joint AGRESCO meeting, three varieties *viz.* Groundnut (GJG-32), Castor (GCH-9) and Papaya (GJP-1) were recommended for release in the state. Besides, 39 technologies/recommendations were made for farmers and 25 recommendations were made for scientific community. In addition, as many as 120 new technical programs were approved to initiate the new research programs for the solutions of the applied and basic problems of agriculture and allied fields.

Table 4.2.5 13th Combined Joint AGRESCO meeting of SAUs

Sub Committee	No. of Recommendations		New Technical Programs
	Farmers	Scientific	
Crop Improvement	03*	-	02
Crop Production	13	04	23
Plant Protection	04	08	25
Horticulture & Agro Forestry	06	01	12
Agricultural Engineering	08	01	13
Animal Science	01	06	07
Fisheries Science	05	01	07
Basic Science	02	02	15
Social Science	-	02	16
Total	3*+39	25	120

*Variety released

** Variety included in Crop Improvement



All India Coordinated Research Projects (AICRP)

Apart from the mechanism of evaluating and monitoring the research programs / schemes at university level; the projects sanctioned by ICAR, the annual workshop and review meetings in different universities in India are organized. Twenty AICRP projects are operating in the university. The monitoring of the projects is also carried out by respective Project Director every year at field level. After five years, the evaluation of performance of

each research project is also carried out by QRT committee comprising of leading senior scientists nominated by the ICAR. The research scientist of the project will present results to the quinquennial review team (QRT). All AICRP projects operating in the university are regularly reviewed and monitored as per the ICAR norms. They identify and evaluate the performance of the research projects according to national standards.

Table 4.2.6 Monitoring of AICRP trial at JAU, Junagadh

Name of Project	Department/ Research Station	Date of Monitoring	Name and designation of member of monitoring
AICRP on FIM	Dept. of FMP, CAET, JAU	August 10, 2016	Dr. C.R. Mehta, PC, AICRP on FIM
AICRP - Pearl millet	Pearl millet Research Station, JAU, Jamnagar	October 3-4, 2016	1. Dr. L. D. Sharma, Prof. (Pl. Br.) and Dr. Sunita Gupta, Prof. (Pl. Physio.), Jaipur 2. Dr. U. S. Tiwana, Prof. (Agron.), Ludhiana 3. Dr. R. K. Pandya, Prof. (Patho.), Gwalior
AICCRIP	Cotton Research Station, JAU, Junagadh	October 18, 2016	1. Dr. K. Sankarnarayanan, P I (Agron.) CICR, Coimbatore 2. Dr. Rajesh Patil, Plant Breeding 3. Dr. S.S. Udikeri, Principal Sci. (Ento.) 4. Dr. K.B. Pawar, Junior Pathologist
AICRP - Castor	Main Oilseeds Research Station, JAU, Junagadh	December 2-3, 2016	1. Dr. P. Duraimurugam, Sr. Sci. (Ento.) and Dr. S. Senthilvel, Sr. Sci. (Pl.Br.), IIOR, Hyderabad 2. Dr. A.V. Ramaneyala, Agronomist, Palem
AICRP - Chickpea	Pulses Res. Station, JAU, Junagadh	February 07, 2017	1. Dr. Vijay Prakash, Principal Sci. (Pl. Br.) 2. Dr. Dashrath Prasad, Sr. Sci. (Agro.)
All India Coordinated Wheat Improvement Program	Wheat Research Station, JAU, Junagadh	February 14, 2017	1. Dr. S. V. Sai Prasad, Principal Sci., Indor 2. Dr. J. P. Chaudhary, Agronomist, Udaipur 3. Dr. Jitmal Dhakar, Professor, KAO, (Kota) 4. Dr. K.K. Mishra, Pathologist, JNKVV, Powarkheda 5. Dr. Satish Kumar, Scientist, IIWBR, Karnal



Table 4.2.7: List of AICRPs functioning in the university (ICAR 75% & State Govt. 25%)

Sr. No.	Budget Head	Scheme	Sanction Year	Location
1	2002-00	AICRP on Pearl millet	1969	Pearl millet Res. Station, Jamnagar
2	2004-00	AICRP on Wheat	1987	Wheat Res. Station, Junagadh
3	2008-01G	AICRP on Groundnut	1987	Oilseed Res. Station, Junagadh
4	2008-1C	AICRP on Castor	1968	Oilseed Res. Station, Junagadh
5	20-1SM	AICRP on Sesame	1986	Agricultural Res. Station, Amreli
6	2009-00	AICRP on Cotton	1967	Cotton Res. Station, Junagadh
7	2013-01	AICRP on Vegetable	1988	Vegetable Res. Station, Junagadh
8	2258-D	AICRP on Farm implements & machinery	2015	Dept. of Farm Machinery & Power, CAET, Junagadh
9	2030-01	AICRP on Long term fertilizer experiments	1999	Dept. of Ag. Chemistry & Soil Science, CoA, Junagadh
10	2040-00	AICRP on Cropping system research (CSR sub centre)	1989	Department of Agronomy, CoA, Junagadh
11	2042-01	AICRP on Dry land agriculture	1971	Dry Farming Res. Stat., Targhadia
12	2076-02	AICRP on BSP-NSP seed technology research	1984	Pearl millet Research Station, Jamnagar
13	2258-00	AICRP on Post-harvest technology	1980	Dept. of Processing & Food Engg., CAET, Junagadh
14	2374-00	AICRP on Chickpea	1993	Pulses Research Station, Junagadh
15	2374-05	AICRP on Pigeon pea	2000	Pulses Research Station, Junagadh
16	2258-B	AICRP on Plastics engineering & technologies	2005	Dept. of Renewable Energy & Rural Engg., CAET, Junagadh
17	2258-A	AICRP on Ground water utilization	2004	Dept. of Soil & Water Engg., CAET, Junagadh
18	2305-03	Network project on buffalo	2001	Cattle Breeding Farm, Junagadh
19	2303-08	Gir germ plasm unit	2009	Cattle Breeding Farm, Junagadh
20	2303-09	Gir data recording unit	2009	Cattle Breeding Farm, Junagadh



Adhoc Research Projects

The university is also undertaking various adhoc research projects of ICAR, Govt. of India, Govt. of Gujarat and Private Agencies. According to

their terms and conditions, research work is carried out and research report is submitted to concern funding agency.

Table 4.2.8: List of Adhoc Research Projects functioning in the university

Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
1	18008-43	Devp. and promotion of promising varieties/ lines with high yield and high oil content with enhanced O/L ratio for enhancing production and quality of groundnut oil in drought-prone environments to boost the income of small and marginal groundnut farmers in india.	2011	ICRISAT, Hyderabad	Oilseed Research Station, Junagadh
2	18005-10	Genetically enhanced micronutrient-dense pearl millet grains for improved human nutrition in the India	2010	ICRISAT, Hyderabad	Pearl Millet Research Station, Jamnagar
3	18246-99	Screening of high biomass populations breeding lines and hybrids in Gujarat	2013	ICRISAT, Hyderabad	Pearl Millet Research Station, Jamnagar
4	18246-98	Heterotic pool formulation in pearl millet	2015	ICRISAT, Hyderabad	Pearl Millet Research Station, Jamnagar
5	18053	Scheme for creating permanent machinery for studying the cost of cultivation/ production of principal crops grown in Gujarat state(Non plan under DAG)	1984	DAG, Govt. of Gujarat	Dept. of Agril. Economics, Junagadh
6	18005-04, 05 & 15	Agricultural demonstration activities in SSP command area Ph-II	2010	SSNNL, Govt. of Gujarat	DFRS, Jam Khambhaliya / Vallbhipur, Agri. School, Halwad
7	18311-12	Mapping and marine fish biodiversity along the Veraval coast using mtDNA barcoding.	2012	GSBTM, Govt. of Gujarat	College of Fisheries Science, Veraval



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
8	18019-04	Effect of sulphate of potash (SOP) with and without FYM on yield and quality of summer groundnut	2015	Gujarat Council of Sci.&Tech.	Dept. of Agril. Chem. & Soil Science, Junagadh
9	18005-18	Establishment of model organic farm	2015	Director of Agri., GoG	Dept. of Agronomy, Junagadh
10	18005-01	Experimental agro-met advisory services	1996	GOI	Dept. of Agronomy, Junagadh/ Dry Farming Res. Station, Targhadia
11	18126-02	Centrally sponsored scheme (Spices)	2006	GOI	Vegetable Research Station, Junagadh
12	18127-00	Seed production in agricultural crops and fisheries	2006	GOI	(Oilseed-Megaseed) Junagadh
13	18127-00	Seed production in agril.crops and fisheries (Oilseeds-Megaseeds)	2006	GOI	(Oilseed-Megaseed) Junagadh
14	18803-01 to 12	Megaseed revolving fund	2006	GOI	(Oilseed-Megaseed) Junagadh
15	18804-01 to 04	Seed production in agricultural crops	2006	GOI	(Oilseed-Megaseed) Junagadh
16	18005-06	Forecasting agricultural output using space, agro meteorology and land based observations (FASAL)	2011	GOI	Dept. of Agronomy, Junagadh
17	18025-04	Effect of optically active substances on diversity in phytoplankton community structure of Gujarat.	2013	GOI	Fisheries Research Station, Okha
18	18025-05	Ocean state forecast validation and research (Okha and Veraval coasts of Gujarat)	2013	GOI	Fisheries Research Station, Okha
19	18003-10	Utilization of chickpea genome sequence for crop improvement	2014	GOI	Pulse Research Station, Junagadh
20	18246-94	Enzymatic pre-treatment in the processing of pigeon pea	2014	GOI	Dept. of PFE, CAET, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
21	18055	Estimation of coconut yield and production in the state of Gujarat	2015	GOI	Dept. of Agril. Economics, Junagadh
22	2012	All India network research project on onion and garlic	2009	ICAR-Network	Vegetable Research Station, Junagadh
23	2030-2	Soil test based fertilizers application for targeted yield of Bt cotton in Saurashtra region of Gujarat	2010	ICAR-Network	Dept. of Agril. Chem. & Soil Science, Junagadh
24	2042-02	National initiative on climate resilient agriculture-dry land	2011	ICAR-Network	Dry Farming Research Station, Targhadia
25	2044-14	National initiative for climate resilient agriculture-ground water	2011	ICAR-Network	Dept. of SWE, CAET, Junagadh
26	2002-03	National surveillance program for aquatic animal diseases	2013	ICAR-Network	College of Fisheries Science, Veraval
27	2002-5	Implementation of protection of plant varieties and farmer's rights legislation	2002	ICAR-Network	Pearl millet Research Station, Jamnagar
28	2027-04	Network project on market intelligence	2013	ICAR-Network	Dept. of Agril. Economics, Junagadh
29	2004-1	Project for frontline demonstration in wheat		ICAR-Network	Wheat Research Station, Junagadh
30	2008-3	Project for frontline demonstration in sesame	2007	ICAR-Network	Agriculture Research Station, Amreli
31	2008-11	Need based research on AICRP on castor	-	ICAR-Network	Oilseed Research Station, Junagadh
32	2008-12	Scheme for breeder seed production of oilseeds crops (ICAR revolving fund)	2007	ICAR-Network	Oilseed Research Station, Junagadh
33	2009-1	Remittance of TMC-MM-1 (Cotton)	2007	ICAR-Network	Cotton Research Station, Junagadh
34	2009-6	Front line demonstration on cotton	2001	ICAR-Network	Cotton Research Station, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
35	2076-3	Central sector special food grain production of breeder seed (Revolving fund)	-	ICAR-Network	Pulses Research Station, Junagadh
36	2254	Study storage losses of food grains	2013	ICAR-Network	Dept. of PFE, CAET, Junagadh
37	2259	Testing fees for conduct of AICMIP	2002	ICAR-Network	Pearl Millet Res. Stat., Jamnagar/ Agril. Res. Stat., Talaja
38	2374-1	FLD on Chickpea	-	ICAR-Network	Pulses Research Station, Junagadh
39	2374-6	FLD on Pigeon pea	-	ICAR-Network	Pulses Research Station, Junagadh
40	2504-00	Revolving fund horticulture (Nursery)	-	ICAR-Network	Dept. of Horticulture, Junagadh
41	2704-40	Project for frontline demonstration on groundnut	1999	ICAR-Network	Oilseed Res. Station, Junagadh/ Agril. Res. Stat., Amreli
42	2704-43	Project for frontline demonstration in pearl millet	1989	ICAR-Network	Pearl millet Research Station, Jamnagar
43	2002-07	Consortia research platform (CRP) on biofortification	2014	ICAR-Network	Pearl millet Research Station, Jamnagar
44	2004-2	Shuttle breeding for developing wheat genotypes for warmer areas	2015	ICAR-Network	Wheat Research Station, Junagadh
45	18246-95	Initial varietal trial in Pearl millet & Chenchrus setigerus in kharif-2015	2015	ICAR-Network	Grassland Research Station, Dhari
46	2030-07	Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor	2015	ICAR-Network	Dept. of Biochemistry, Junagadh
47	2030-08	Transcriptome analysis in coriander for identification of candidate genes against stem gall disease	2015	ICAR-Network	Dept. of Biochemistry, Junagadh
48	2030-09	Genome and transcriptome sequencing of cumin (cuminum cyminum) to reveal insight of its genomic architecture	2015	ICAR-Network	Dept. of Biochemistry, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
49	18005-18	Establishment of model organic farm	2015	GOG	Dept. of Agronomy, Junagadh
50	18132	Creation of seed-hubs for increasing indigenous production of pulses in India	2016	ICAR-Network	Dept. of Seed Science & Tech., Junagadh
51	18024-13	Genome and transcriptome sequencing of coriander (<i>Coriandrum sativum</i>) to reveal insight of its genomic architecture and breeding targets	2016	GOG	Dept. of Biotechnology, Junagadh
52	18311-17	Evaluation of fish meal substitution with plant proteins in formulated feed in rohu (<i>Lebeo rohita</i>) through nutrigenomics approach	2016	GOG	Dept. of Biotechnology, Junagadh
53	18055-02	Estimation of coconut yield and production in the state of Gujarat	2017	GOI	Dept. of Economics, Junagadh
54	18303-14	Technical assistance for wild life health care, diseases diagnosis and therapeutic management	2017	GOG	College of Veterinary Science & Animal Husbandry, Junagadh
55	18802-03	Use of molecular markers in testing genetic purity of dwarf and tall coconut population at Mangrol (Agri. Res. Station) and Mahuva (Fruit Res. Station) sub-center of JAU, Junagadh	2017	GOG	Wheat Research Station/ Dept. of Genetics & Plant Breeding, Junagadh
56	18803-12	Centre for entrepreneurship development on agri. and allied sci.	2016	GOG	Dept. of Seed Sci. & Technology, Junagadh
57	18009-33	Proliferation of Bt-gene in native cotton varieties of Gujarat	2017	GOG	Cotton Research Station, Junagadh

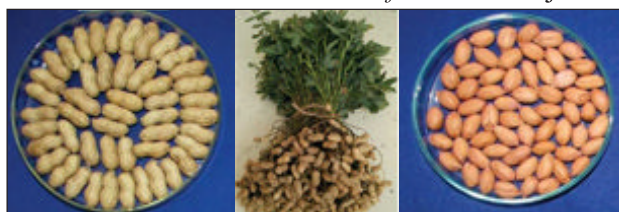
4.3 Crop Improvement

New crop varieties

Three varieties viz. Groundnut (GJG-32), Castor (GCH-9) and Papaya (GJP-1) were recommended for farmers of the state during 2016-17.

Groundnut: Gujarat Junagadh Groundnut 32 (GJG 32)

The Spanish bunch groundnut variety, Gujarat Junagadh Groundnut 32 (GJG 32) recorded mean pod yield of 3392 kg/ha, which was 22.6, 22.6 and 15.4 per cent higher than the check varieties GG 7 (2766 kg/ha), GJG 9 (2765 kg/ha) and TG 37A (2816 kg/ha), respectively. It has higher oil content (53.9 %), oil yield (1253 kg/ha) and protein content (27.5 %) as compared to the check varieties GG 7 (48.9 %, 945 kg/ha and 24.5 %), GJG 9 (49.3 %, 978 kg/ha and 24.5 %) and TG 37A (49.9 %, 993 kg/ha and 26.4 %), respectively. It is more resistant to tikka and rust diseases than the check varieties. The variety is recommended for release in *kharif* season in Gujarat.



Castor: Gujarat Castor Hybrid 9 (GCH-9)

Gujarat Castor Hybrid 9 (GCH 9) gave seed yield of 3820 kg/ha, which was 9.0 per cent higher than check GCH 7 (3503 kg/ha). It is resistant to *Fusarium* wilt and *Macrophomina* root rot and tolerant to sucking pests. It is a medium duration hybrid having profuse branching habit and shallow cup shape leaves with medium plant stature and 48.3 per cent seed oil content. The variety is recommended for release under irrigated condition in Gujarat.



Papaya: Gujarat Junagadh Papaya 1 (GJP 1)

Gujarat Junagadh Papaya 1 (GJP 1) recorded fruit yield of 84.5 t/ha, which was 59.1 per cent higher than the check variety Pusa Dwarf (53.1 t/ha). It is early in flowering with more number of fruits per plant. The fruits are medium in size (1.650 kg) with pyriform shape. The fruit possesses higher pulp to seed ratio, pulp and sugar content and better organoleptic characters than check Pusa Dwarf. The variety is recommended for release in Saurashtra region.



4.4 Crop Production

Recommendation for Farmers' Community

Nutrient Management

Response of castor to potash at varying crop geometry

The farmers of South Saurashtra Agro-climatic Zone growing irrigated castor in soil having medium status of potash are advised to sow castor at spacing of 150 cm x 60 cm with an application of potash @ 40 kg/ha along with recommended dose of nitrogen and phosphorus (120:50 kg NP/ha) for obtaining higher seed yield and net return.



Phosphorus management in sesame under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone growing rainfed sesame are advised to fertilize the crop with 25 kg P₂O₅/ha as basal through Single Super Phosphate (SSP) along with recommended dose of nitrogen (50 kg N/ha) for getting higher yield and net return.



Effect of foliar fertilizer in Bt. cotton. G. Cot. Hy. 8 (BG-II)

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton under irrigated condition are advised to apply recommended dose of fertilizer (240:50:150 NPK kg/ha) and spraywater soluble fertilizer 1 % (19:19:19 NPK) at flowering, boll formation and boll development stage of the cotton to obtain higher seed cotton yield and net return.

Effect of multi-micronutrient formulations on tomato

The farmers of South Saurashtra Agro-climatic Zone growing tomato in medium black calcareous soil are recommended to apply micronutrients as per soil test value as basal in addition to recommended dose of fertilizers (75:37.5:62.5 N:P₂O₅:K₂O kg/ha) to tomato for getting higher yield and net return. OR Foliar spraying of multi-micronutrient formulation Grade IV (Fe-Mn-Zn-Cu-B, 4.0-1.0-6.0-0.5-0.5 %) is recommended @ 1% at 45, 60 and 75 DAS in addition to recommended dose of fertilizers (75:37.5:62.5 N:P₂O₅:K₂O kg/ha) to tomato for getting higher yield and net return.

Effect of multi-micronutrient formulations on garlic

The farmers of South Saurashtra Agro-climatic Zone growing garlic in medium black calcareous soil are advised to apply micronutrients as per soil test value as basal in addition to recommended dose of fertilizers (50:50:50 N:P₂O₅:K₂O kg/ha) for getting higher yield and net return. OR Soil application of multi-micronutrient formulation Grade V (Fe-Mn-Zn-Cu-B, 2.0-0.5-5.0-0.2-0.5 %) is recommended @ 40 kg/ha in addition to recommended of fertilizers (50:50:50 N:P₂O₅:K₂O kg/ha) to garlic for getting higher yield and net return. OR Apply foliar spray of multi-micronutrient formulation Grade IV (Fe-Mn-Zn-Cu-B, 4.0-1.0-6.0-0.5-0.5 %) @ 1% at 60, 75 and 90 DAS in addition to recommended dose of fertilizers (50:50:50 N:P₂O₅:K₂O kg/ha) to garlic for getting higher yield and net return.

Package of Practices

Optimizing spacing for medium duration pigeon pea varieties under pigeon pea + Uradbean inter cropping system

The farmers of South Saurashtra Agro-climatic Zone adopting pigeonpea + uradbean (without fertilizer) inter cropping system are advised to sow pigeonpea at 120 cm x 30 cm spacing and two rows of uradbean in between two rows of pigeonpea for getting higher yield and net return.

Suitability of pearl millet hybrids under varying time of sowing during semi *rabi* season

The farmers of North Saurashtra Agro-climatic Zone growing hybrid pearl millet during semi *rabi* season are recommended to sow the pearl millet early maturing variety GHB 538 during first week of October to obtain higher yield and net return.

Weed Management

Integrated weed management in organically grown groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut under organic farming are advised to adopt stale seedbed technique (pre-sowing irrigation + killing of weed flush by harrowing) and kept weed free condition throughout the crop growth period or carry out hand weeding and interculturing at 15, 30 and 45 days after sowing for effective control of weeds and securing higher net realization.



Weed management practices in spring planted sugarcane-based intercropping system

The farmers of South Saurashtra Agro-climatic Zone interested to grow spring-planted sugarcane with intercropping system are advised to grow one row of sesame or green gram or black gram as

intercrop without fertilizer application in sugarcane planted at 90 cm row spacing for securing higher yield and net return. Weed control should be done with two hand weeding at 20 and 40 days after sowing of intercrop.



Response of cumin to drip irrigation and integrated nutrient management

The farmers of South Saurashtra Agro-climatic Zone growing cumin are advised to irrigate the crop with drip system at 0.6 PEF for getting higher yield and net realization which saves 12.4 % water. Farmers are also advised to apply 75% recommended dose of fertilizer (22.5:11.2:0 kg NPK/ha) along with FYM @ 5 t/ha for getting maximum yield and net return.

The system details as under:

Details
Lateral spacing: 60 cm
Dripper spacing: 45 cm
Dripper discharge rate: 4 lph
Operating pressure: 1.2 kg/cm ²
Operating frequency: Alternate day

Operating time	
Month	Minutes
Dec.-Jan.	20
Feb.-March	30

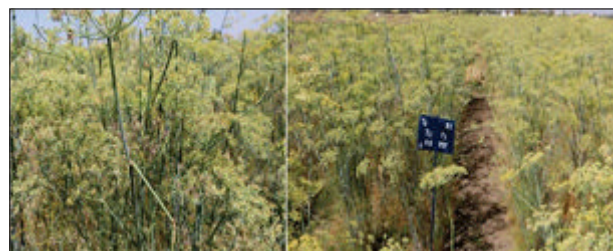


Drip irrigation and fertilizer in drilled *rabi* fennel

The farmers of South Saurashtra Agro-climatic Zone growing *rabi* drilled fennel are advised to irrigate the crop with drip system at 0.8 PEF and apply 120:45:0 NPK kg/ha out of which full dose of phosphorus and 25% nitrogen as basal and remaining 75% nitrogen in three equal splits at 20 DAS in 20 days interval after sowing through drip for getting higher yield and net return. The system details as under:

Details
Lateral spacing: 120 cm (45-75-45 cm paired row)
Dripper spacing: 45 cm
Dripper discharge rate: 4 lph
Operating pressure: 1.2 kg/cm ²
Operating frequency: Alternate day

Operating time	
Month	Minutes
December	58
January	62
February	75
March	95
April	120



Evaluation of drip fertigation on castor productivity

The farmers of South Saurashtra Agro-climatic Zone growing castor are advised to irrigate the crop at 0.8 PEF through drip irrigation and apply nitrogen @ 90 kg/ha (20 kg N/ha as a basal and remaining 70 kg N/ha through drip in form of urea in five equal splits at an interval of 12 days starting after cessation of monsoon) along with recommended dose of phosphorus (50 kg/ha) as basal for obtaining higher yield and net return. The system details are as under:



Details
Lateral spacing : 120 cm
Dripper spacing : 60 cm
Dripper discharge rate : 4 lph
Operation pressure : 1.2 kg/cm ²
Operation frequency: Every 3 rd day irrigation

Operating time	
Month	Minutes
October	110-125
November	100-110
Dec.-Jan.	95-105
-	-
-	-



Response of summer groundnut to fertilizer dose and plant population under drip and check basin method

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are advised to apply initially two normal irrigations and remaining through drip at 0.8 PEF (20 DAS) and apply water soluble fertilizer (N:P:K:17:44:0) @ 75 % of RDF (18.75:37.5 kg NP/ha) in five equal splits through fertigation at an interval of 8 days starting from 20 DAS and maintain spacing 20 cm x 10 cm (plant population @ 5.00 lakh/ha) for higher yield and net return which save 23 per cent water and 25 per cent fertilizer.

The system details are as under:

Details
Lateral spacing : 60 cm
Dripper spacing : 45 cm
Dripper discharge rate : 4 lph
Operation pressure : 1.2 kg/cm ²
Operation frequency : Alternate day

Operating time	
Month	Minutes
February	75-80
March	100-110
April	120-125
May	130-135
-	-



Recommendation for Scientific Community

Weed management practices in spring planted sugarcane-based intercropping system

It is for the knowledge of the scientific community that application of pendimethalin @ 0.90 kg/ha as pre-emergence followed by hand weeding at 30 days after sowing of sesame or green gram or black gram as intercrop in sugarcane planted at 90 cm row spacing gives higher yield and net return as well as it gives effective weed management.

Yield maximization in medium duration pigeon pea crop

It is for the knowledge of the scientific community that grow pigeonpea by adopting full package of practices [INM (FYM 5t/ha + RDF (N:P:S:Zn: 25:50:20:15 kg/ha + IWM (Pendimethalin 30% EC @ 0.75 kg a.i./ha at 3 DAS + Imazethapyr @ 100 g a.i./ha at 10-15 DAE of weeds +

1 HW at 50 DAS) + IPM (Indoxacarb 15.8% EC at flowering @ 375 ml/ha + Chloramiprole 18.5 SC at 15 days after 1st spray @ 100 ml/ha)]. Among the production factors, maximum contribution was shown by INM (54.75 %) followed by IWM (43.83 %) and IPM (35.74 %).

Establishment of critical limit of sulphur for pigeon pea crop in medium black calcareous soils

The critical limit for sulphur application to pigeon pea crop grown on calcareous soils of Saurashtra has been fixed. The limit is noticed as 12.5 ppm (Heat soluble S) in soil and 0.455 per cent in pigeon pea plant at 60 DAS.

Effect of saline irrigation water on onion (*Allium cepa*) crop

It is for the information of scientific community especially for plant breeder that onion variety Talaja Red recorded value of different salt tolerance criteria like higher mean salinity index (53.8), higher mean bulb yield (109 g) minimum yield decline in high salinity level at EC 6.80 dSm⁻¹ for 50 %, minimum yield reduction (59.3 %) at 8.0 dSm⁻¹ as well as lower Na/K ratio in straw. Onion variety Talaja red is found more salt tolerant compared to GWO-1, Pilipatti and Agri Found Light Red on the basis of salinity indices.



4.5 Plant Protection

The research work carried out by plant protection group is to develop the economically viable technology for increasing production of agricultural commodities without any adverse effect on the environment and livelihood of the people.

Recommendation for Farmers' Community

Agricultural Entomology

Field efficacy of different insecticides against citrus pests

The farmers of South Saurashtra Agro-climatic Zone growing citrus are advised to apply two sprays of imidacloprid 17.8 SL 0.0072 % (4 ml/10 lit. water), first spray at starting of pests infestation and second 15 days after the first spray for effective management of leaf miner and black fly.



Evaluation of botanicals, bio-pesticides and insecticides against gram pod borer

The farmers of South Saurashtra Agro-climatic Zone growing chickpea are advised to apply alternate spray of HaNPV 2×10^9 POBs/ml (5 ml/10 lit. water) and chlorantraniliprole 18.5 SC 0.004 % (2 ml/10 lit. water) for effective and economic control of pod borer (*Helicoverpa armigera*) in chickpea crop. First spray to be started at 50 % flowering and second at 15 days after first spray.

The PHI for chlorantraniliprole 18.5 SC is 11 days.



Integrated cotton crop management with emphasis on biotic stress

The farmers of South Saurashtra Agro-climatic Zone growing cotton are advised to apply the following Integrated Pest Management module for control of mealy bug and conservation of lady bird beetle. However, IPM module also reduced the population of aphids, jassid, thrips, whitefly, mite, mirid bug and maintain population of predators i.e. chrysopa and spider as compared to CFP module but they were non-significant.

1. Seed treatment with *Pseudomonas fluorescens* @ 10g/kg of seed
2. Sowing of castor as a trap and maize as a border crop (10:1)
3. Sowing of black gram as intercrop
4. Fertilizer application of FYM 10 t/ha + 180:37.50:112.50 NPK kg/ha in three split at basal, 30 DAS and 60 DAS
5. Need based application of insecticides in sequence viz., acephate 75 SP (0.113%) 750 g a.i/ha (20 g /10 lit. water), flonicamid 50 WG (0.015%) 75 g a.i/ha (3 g/10 lit. water), fipronil 5 SC (0.008%) 40 g a.i/ha (16 ml /10 lit. water) and buprofezin 25 SC (0.05%) 250 g a.i/ha (20 ml/10 lit. water).
6. Pre-emergence application of pendimethalin 30 EC (0.20%) @ 1000 g a. i./ha (67 ml/10 lit. water) and quizalofop ethyl 5 EC (0.01%) @ 50g a. i./ha (20 ml/10 lit. water) 30 DAS for weed control.
7. Installation of yellow sticky trap @ 5 traps/ha for monitoring of white fly.
8. Installation of pheromone traps @ 5 traps/ha for monitoring of all bollworms.
9. Need based application of copper oxychloride 50 % WP 0.2 % (40 g/10 lit. water) and carbendazim 50 % WP (0.05 %) (10 g /10 lit. water) for disease control.



Plant Pathology

Biological control of soil borne diseases of sesame

The farmers of North Saurashtra Agro-climatic Zone growing sesame are advised to treat seed with *Trichoderma harzianum* 1 % WP 5 g/kg seed or *Pseudomonas fluorescens* 1 % WP 5 g/kg along with soil application of *Trichoderma harzianum* 1 % WP 2.5 kg/ha with 300 kg FYM or castor cake at the time of sowing were found effective and economical for management of soil borne diseases (*Macrophomina* stem rot and *Phytophthora* blight) of sesame.

Recommendation for Scientific Community

Entomology

Field efficacy of different insecticides against citrus pests

Two sprays of spinosad 45 SC 0.0135 % (3 ml/10 lit. water) and difenthiuron 50 WP 0.05 % (10 ml/10 lit. water) at 15 days interval starting from pests infestation was found effective for management of leaf miner and black fly in South Saurashtra Agro-climatic Zone.

Survey of various insect-pests of pomegranate in Saurashtra region

The incidence of anar butterfly and thrips were found enormous during the month of January to April and September to December, respectively. The maximum population of anar butterfly was noticed in Junagadh region, while thrips was found maximum in Kalawad area.



Evaluation of some newer insecticides against the leaf weber, *Antigastra catalaunalis* (Duponchal) infesting sesame under rainfed condition

Two sprays of insecticides i.e. indoxacarb 14.5 SC 0.007 % (4 ml/10 lit. water) or spinosad 45 SC 0.009 % (2 ml/ 10 lit. water) or emamectin benzoate 5 SG 0.002 % (4 g/10 lit water) or profenophos 50 EC 0.005 % (10 ml/ 10 lit. water) or chlorantraniliprole 20 EC 0.006 % (3 ml/ 10 lit water) (first at ETL of the pest 5 larvae/ 20 plant and second at 15 days after first spray) found effective for management of sesame leaf weber in North Saurashtra Agro-climatic Zone. There was no problem of residue of all the insecticides in sesame seeds at 30 days after second (last) spray application.



Initiation and development of aphid and jassid in relation to different weather parameters on groundnut crop under rainfed condition

The incidence of thrips on groundnut was commenced in 26thSW and reached to a peak in 33rdSW. The influence of wind speed was found significant on thrips population, while, other abiotic factors have no significant effect. All the abiotic factors had non-significant effect on aphid and jassid population in groundnut.

Testing of insecticides against major pests of sesame

Two sprays of lamda cyhalothrin 5 EC 0.005 % (10 ml/10 lit. water) or emamectin benzoate

5 SG 0.0035 % (7 g/10 lit. water) (1stspray at ETL of 0.25 larva/plant and 2nd bspray at 15 days after 1stspray) found effective and economic for management of leaf weber of sesame in *kharif* in North Saurashtra Agro-climatic Zone.

Two sprays of dicofol 18.5 EC 0.037 % (20 ml /10 lit. water), 1stspray at appearance of mite and 2nd spray at 15 days after 1stspray found effective and economical. Residues of above pesticides in sesame seed were not detected at 30 days after 2nd spray.

Evaluation of botanicals, bio-pesticides and insecticides against gram pod borer

Two spray of profenofos 50 EC 0.13 % (26 ml/10 lit. water) and chlorantraniliprole 18.5 SC 0.004 % (2 ml/10 lit. water) were found effective and economic management of pod borer (*Helicoverpa armigera*) in chickpea crop. First spray should be started at 50 % flowering and second at 15 days after first spray. The PHI for chlorantraniliprole 18.5 SC and profenofos 50 EC are 11 and 27 days, respectively.

Bioefficacy of different insecticides against castor shoot and capsule borer

Two sprays of spinosad 45 SC 0.009 % (2 ml/10 lit. water) or chlorantraniliprole 18.5 SC 0.006 % (3.2 ml/10 lit. water) at 15 days interval starting from pest infestation found effective and economical for the management of castor shoot and capsule borer.

Plant Pathology

Wilt disease development in popular cultivars as influenced by different dates of sowing under changing climate in chickpea

The popular chickpea cultivars viz. JG 16, GG-1, GJG 3 and GG 5 exhibited low wilt incidence and high grain yield as compared to JG 62 (susceptible cultivar). The lowest wilt incidence was recorded in JG 16. In case of date of sowing, no significant differences in wilt incidence and grain yield were found. The low wilt incidence was recorded in normal date of sowing (5thNovember). Therefore; it was determined that popular cultivars possessed resistance against wilt disease till today.

4.6 Horticulture and Agro Forestry

Recommendation for Farmers' Community

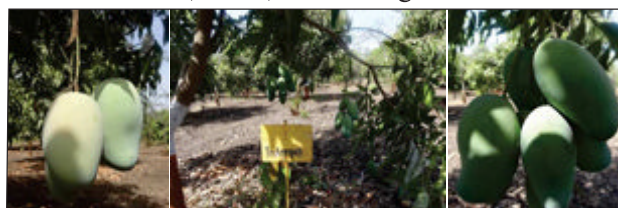
Varietal evaluation of strawberry under polyhouse

Farmers of South Saurashtra Agro-climate Zone, interested in strawberry cultivation, are advised to grow cv. Winter Queen under protected structure (Fan-pad Cooling Poly House) for getting higher yield and net return.



Evaluation of small to medium sized varieties of Mango

Farmers of Saurashtra region growing small to medium size mango (150 to 250 g) are advised to grow variety Kesar and as alternate of Kesar variety, hybrid variety Amrapali for better yield from thirteen years old tree. Both varieties possess medium sized fruits with attractive colour, flavor, aroma and good taste.



Evaluation of medium to large sized varieties of Mango

Farmers of Saurashtra region growing medium to large sized mango (250 to 500 g) varieties for

getting higher yield are advised to grow mango hybrid Sonpari or Rajapuri. The variety possesses good quality with attractive and large sized fruits.



Performance of leafy vegetables purpose coriander under different shed net in summer season

The farmers of Saurashtra region interested to grow coriander for green coriander purpose in summer season are advised to use 75 % white shed net in low cost shed net house for securing higher yield and net return.



Integrated nutrient management in mango cv. Jamadar

The farmers of South Saurashtra Agro-climatic Zone interested to grow mango cv. Jamadar are recommended to apply fertilizers as per following schedule for securing higher yield and net return.

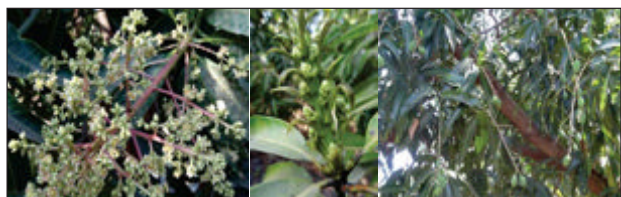
Age of tree (Year)	Poultry manure (kg/plant)	N (g/plant)	P (g/plant)	K (g/plant)
4 th year	20	160	64	232
5 th year	25	200	80	290
6 th year	30	240	96	348
7 th year	35	280	112	406



Recommendation for Scientific Community

Effects of climate change on flowering and yield of mango cv. Kesar

It is recommended to scientific community that the climatic parameters like temperature, humidity, rainfall, bright sun shine hours and wind velocity influenced the flowering, fruit setting, fruit dropping, number of fruit per plant and fruit yield. Higher day temperature with lower night temperature as well as more fluctuation in day & night temperature disturb the flowering, pollination and fruit setting process. Similarly, higher humidity, dew, late rain or off seasonal rain during flowering also affects adversely. Mango requires 25-30 °C day temperature & 15-18 °C night temperature, 40-45% humidity, no dew formation, lower late rain (September), higher sun shine hours (8-9 hrs.) during floral bud initiation, flowering and fruit setting.



4.7 Agricultural Engineering

The Agricultural Engineering group accomplished the studies on design, development & fabrication of agricultural machinery, equipment, tools, renewable energy, processing and soil & water management.

The “Testing and Training Center of Farm Machinery” under the Department of Farm Machinery and Power, CAET, JAU, Junagadh was established in August, 2008 by the State Govt. with the financial support from the Central Govt. under Rashtriya Krishi Vikas Yojna (RKVY) with total outlay of project as Rs. 535.00 lacs. It is on the line of testing of agricultural machines carried out by Farm Machinery Testing and Training Institutes (FMTTIs), established by the Govt. of India. This Center is one of the twenty five institutions approved by the Department of Agriculture & Co-operations, Ministry of Agriculture, GoI in the direction of ensuring supply of quality agricultural machinery and equipment under Government programs. Various types of equipments produced by the manufacturer of the state and national level have been received for evaluation of their work performance and feasibility.

Table 4.7: No. of Farm Machineries / Implements tested (Category wise)

Category	Name of Equipment / Machine	Nos.
A	Land development, tillage & seedbed preparation equipment	43
B	Sowing and planting equipment	21
C	Intercultivation equipment	0
D	Plant protection equipment	37
E	Harvesting and threshing equipment	34
F	Equipment for residue management	8
G	Post-harvest and agro processing equipment	1
H	Hand tools	0
	Total	144

Recommendation for Farmers' Community

Design and development of a tractor mounted rural transporter

Farmers are recommended to use tractor mounted “JAU Rural Transporter” for carrying up to

500 kg live/dead load for better safety and fatigue reduction as compared to carrying on tractor mudguard or trailer. Rural transporter is also released for commercial exploitation.

Effect of protected environment on off-season seedling raising of Papaya

The farmers of South Saurashtra Agro-climatic Zone interested to raise papaya seedling in protected structure are advised to use poly-cum-shade net house covered with 50% white shade net on periphery and roof covered with 200 micron UVS polyethylene sheet.



Details of mulching technology

1	Mulch film: 20 μ m silver black plastic
2	Bed size: (a) Top width: 75 cm (b) Bottom width: 90 cm (c) Height: 20 cm
3	No. of rows per bed : 3
4	Spacing: (a) Bed spacing :120 cm (b) Row spacing: 20 cm (c) Plant spacing: 20 cm

Details of drip system

1	No. of laterals / bed : 2
2	Lateral spacing: 20 cm
3	Dripper spacing: 40 cm
4	Dripper discharge: 2 lph
5	Irrigation scheduling : a. Feb.: 10 to 15 min/day b. March: 30 to 35 min/day c. April: 40 to 45 min/day d. May: 55 to 60 min/day



Aquifer mapping of Uben river basin

The farmers, NGOs and line department's people are advised to construct ground water recharge structures and shaft recharging technique for augmenting ground water resources around the area starting from Sakkarbaugh, Vadal, Choki, Makhiyala up to Fareni. Keeping in view the higher horizontal, vertical hydraulic conductivity and transmissibility of unconfined/ confined aquifer. The surface water harvesting structures should be encouraged for augmenting the surface water resources in rest parts of the Uben basin.

Conjunctive effect of emitter configuration and irrigation regimes on productivity of cumin

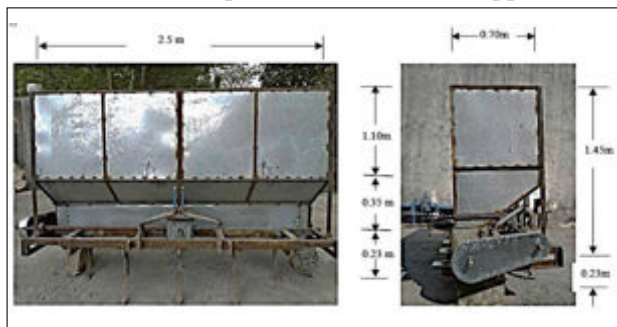
Farmers of South Saurashtra Agro-climatic Zone growing cumin are advised to adopt drip irrigation with triangular geometry having 0.6 m lateral spacing and 2 lph emitter discharge and to irrigate at 4 days interval with 0.8 IW/ETc (2 hours) for acquiring higher yield (38%), water use efficiency (60.95%), water productivity (61%) and net return (38.87%) as compared to farmers' practices.



Design and development of tractor operated FYM applicator

Tractor operated Farm Yard Manure applicator developed by Junagadh Agricultural University is recommended for farmers' use and for commercial

exploitation to apply FYM at desired row spacing within furrow as per requirement. It saves time and economical as compared to manual FYM application.



Rain water management for sustaining cotton productivity in medium black soils under dry farming conditions

The farmers of North Saurashtra Agro-climatic Zone growing Bt. cotton are advised to apply FYM @ 10 t/ha and kaolin @ 4 % spray (400 g/10 liter water) at dry spell for obtaining higher productivity and maximum net returns as well as for getting maximum rain and crop water use efficiency under dry farming conditions.

Rainwater management for sustaining groundnut productivity in medium black soils under dry farming conditions

The farmers of North Saurashtra Agro-climatic Zone growing groundnut (GG 20) are advised to apply FYM @ 10 t/ha and kaolin @ 4 % spray (400 g/10 liter water) at dry spell for obtaining higher productivity and net returns as well as maximum rain and crop water use efficiency under dry farming conditions.

Recommendation for Scientific Community

Vibration study and its attenuation through coating on mini tractor seat

Mini tractor operators / manufacturers are recommended to use operator's seat coated on both sides by natural rubber [density-0.978 g/cc; thickness-10 mm & hardness-50], which resulted in significant attenuation of whole body vibration of operator along with enhanced operating time, as per BIS / ISO standards under all operating conditions with & without trailer on tar road, farm road and field.

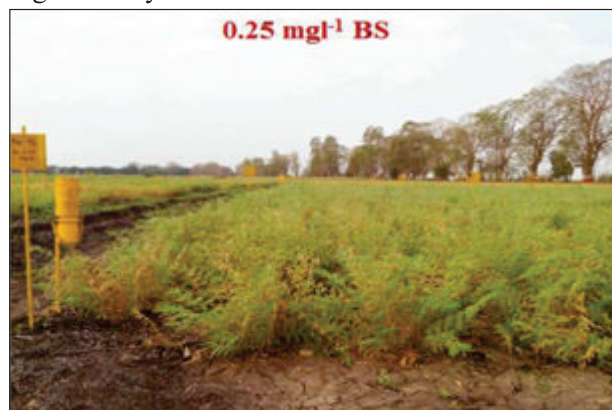
4.8 Basic Science

Basic Science group consists of plant pathology, bio-chemistry and plant molecular biology are given here in.

Recommendation for Farmers' Community

Effect of brassinolide on physiological and yield related traits of chickpea and their relationship with yield

The farmers of South Saurashtra Agro-climatic Zone growing chickpea under irrigated condition are advised to use growth regulator Brassinolide (BS) as a seed treatment for 2 hrs @ 0.50 mg/lit. (0.04 % i.e. 12.5 ml BS and make up 10 liter solution) to obtain higher seed yield and net return.



Efficiency of foliar spray of growth regulating substances for enhancing seed yield of pearl millet under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are advised to go for foliar application of potassium chloride 1.5 % (7.5 kgha⁻¹ in 500 liter water) at 30-35 and 50-55 DAS for higher vegetative growth, seed yield and net return.

Recommendation for Scientific Community

Effect of organic seed treatment on storability of wheat

It is informed to scientific community that wheat seed may be stored under ambient storage condition packed with cloth bag with seed treatment of neem leaf powder or sweet flag rhizome powder @ 2-5 g/kg of seed or neem seed kernel powder @ 2 g/kg seed for a period of 20 months without deterioration in germination and seedling vigour.



Biochemical and molecular characterization of phosphate solubilizing bacteria from different soil rhizosphere

It is informed to scientific community that among 17 PSBs, isolate derived from chickpea rhizosphere exhibited highest phosphate solubilizing index followed by isolates from pigeon pea rhizosphere and poultry farms. The best PSBs were confirmed as *Pseudomonas putida* and *Pseudomonas fulva*.

4.9 Veterinary Science & Animal Husbandry

Cattle Breeding Farm, Junagadh Agricultural University is the largest and oldest farm and is the only organized research station where purebred *Gir* Cattle and *Jaffrabadi* Buffaloes are maintained in the country. This research station is involved since its inception in conservation, improvement and advancement of *Gir* Cattle & *Jaffrabadi* Buffaloes through selective breeding. The herd of *Gir* Cattle was established as early as in 1920 by the erstwhile Nawab of Junagadh State, while *Jaffrabadi* herd was established in the year 1978. Since that this research station always maintains *Gir* Cattle and Buffaloes. Besides maintaining pure breed herds of *Gir* Cattle and *Jaffrabadi* buffaloes at the station, the center is involved in conservation and improvement of field animals of these breeds through Field Progeny Testing programs and supply of high quality males to different Gram Panchayats.

Presently this station has a 134 hectare of land out of which about 30 hectare is pasture land. The subsidiary farm known as Narsi mehta Talav has 16 hectare and Jonpur farm Grass land of 130 hectare from where annually 4 to 5 lakh kg of dry grass is made available for feeding the animals.

ICAR sponsored research projects such as "Genetic improvement in indigenous germ-plasm" and "Network Project on *Jaffrabadi* buffaloes" are the key projects functional at the research station. All India co-ordinated Research Project on Indigenous Germ Plasm-Gir is functional at the research station since 2010. Under this project a set of six *Gir* breeding bulls were introduced for breeding in the field using farmers' herd for Artificial Insemination. From the year 2010 to 2016, 21564 AI were carried out 10464 cows were impregnated, total 4537 daughters were born under the project and 162 daughters milk was recorded in the field.

The 300 days milk yield (Ly 300) of the daughters born to six sires was analyzed by two different methods to estimate the true breeding value of the sires. The analysis revealed that Sire 'Pankaj' was having highest breeding value and was ranked number one with its Sire index 9.25% above herd average and least squares analysis revealed that Sire 'Pankaj' ranked first with its breeding value 5.35% above herd average. Thus breeding bull 'Pankaj' was declared as Proven Sire.

Table: 4.9.1 Sire Index Values for 1st Set of Sires (Gir)

Sr. No.	Name of Sire	Number of Daughter	SI $u + \frac{n}{n+12} (\bar{D} - \bar{CD})$	Least Squares Analysis	Rank
1.	Bhavik	50	2411.5	2644.1 ± 265.4	
2.	Bhola	3	2285	2273.8 ± 396.1	
3.	Murari	34	2247.6	2653.3 ± 272.5	
4.	Pankaj	34	2555.5	2682.2 ± 269.1	01
5.	Raj	6	2216	2340.9 ± 329.8	
6.	Rupak	35	2440.1	2681.6 ± 270.0	02
		Herd Average	2339	2546 ± 263.8	
		Pankaj	9.25 % above H.A.	5.35 % above H.A.	

**Table: 4.9.2 Distribution of Semen doses from CBF**

Sr.No.	Particular	Gir Bulls	Jaffrabadi Bulls
1.	Frozen Semen doses available (Nos.)	139105	129712
2.	Frozen Semen doses Produced (Nos.) (2016-17)	67037	44105
3.	Frozen Semen doses used for AI in Field (Nos.)	2442	2971
4.	Frozen Semen doses used for AI on Farm (Nos.)	478	167
5.	Frozen Semen doses sold to AI Workers (Nos.)	5120	4505
6.	Frozen Semen doses in Stock (Nos.)	139105	129712
7.	Gir/Jaffrabadi bulls distributed to Grampanchayat Gaushala, other Institute etc. (Nos.)	88	58

Table 4.9.3 Total number of cases treated at TVCC, Veterinary Ambulatory Services and Clinical Camps

Animals/ Types of cases	Medicine	Gynecology	Surgery	Total
Cases treated at TVCC				
Cattle	758	264	423	1445
Buffalo	760	385	280	1425
Equine	200	56	574	830
Canine	2139	56	574	2769
Others	468	43	213	724
Sub Total	4325	804	2064	7193
Cases treated through Veterinary Ambulatory Services				
Cattle	213	29	58	300
Buffalo	185	68	69	322
Others	10	0	0	10
Sub Total	408	97	127	632
Cases treated during Veterinary Clinic Camps				
All animals	1115	178	138	1431
Grand Total	5848	1079	2329	9256

Recommendation for Farmers' Community

Hydrocyanic concentration during different stages of growth in Gundri jowar (*Sorgum vulgare*) and Baru (*Sorgum halepense*)

Sorgum vulgare (jowar) and *Sorgum halepense* (baru) fed at 25 per cent flowering stage is safe for ruminants as the HCN content is below the toxic level.



Recommendation for Scientific Community

Preliminary evaluation of antibacterial activity of extracts of selected medicinal plants

Methanolic and chloroform extracts of leaves of *Aristolochia longa* (Kidamari), *Adansonia digitata* (Gorakhamli), *Solanum xanthocarpum* (Bhoi-ringani), *Moringa oleifera* (Saragavo) and *Syzygium cuminii* (Kala-jambu) were found to have significant in-vitro antibacterial activity.



Adansonia digitata

Aristolochia longa

In-vitro anti-inflammatory activity of selected medicinal plants

Extracts from *Argyreia speciosa* leaves (Avali-savali), *Adansonia digitata* leaves (Gorakh ambli), *Flueggea leucopyrus* leaves, *Peltophorum pterocarpum* bark (Pilo gulmohor), *Solanum xanthocarpum* aerial part (Bhoi-ringani) and *Vitex negundo* leaves (Nagod) showed significant in-vitro anti-inflammatory activity.



Argyreia speciosa

Vitex negundo

In-vitro antioxidant activity of extracts of selected medicinal plants

Opuntia elatior (Hathlothor) fruit extracts of *Peltophorum pterocarpum* (Pilo gulmohor) leaves and bark, *Syzygium cuminii* (Kala-jambu) leaves and *Tridax procumbens* (Ghaburi) leaves showed significant in-vitro antioxidant activity.



Opuntia elatior

Syzygium cumini

In-vitro anti-diabetic activity of extracts of selected medicinal plants

Extracts of *Gymnema sylvestre* (*Madhu nashini*), *Lepidium sativum* seed (*Sheliyo*), *Moringa oleifera* (*Saragavo*) leaves and *Pueraria tuberosa* (*Fagiyo*) tuber showed significant in-vitro anti-diabetic activity by inhibition of *-amylase* and *-glucosidase* enzyme activity.



Gymnema sylvestre

Lepidium sativum seed

Effect of various levels of some herbal feed additives in total mixed ratio on in vitro nutrient utilization and rumen fermentation

Garlic bulb powder, fenugreek seed powder and *ashwagandha* root powder can be incorporated at 0.5 % level and ginger rhizome powder at 1 % level in total mixed rations to improve in-vitro degradability and rumen fermentation.



Study of acaricidal resistance status and species of ticks infesting animals presented at TVCC, Junagadh

In Saurashtra region, major ticks of cattle, buffaloes and horses is *Rhipicephalus microplus* (>85 %) and of dog *R. sanguineus* (\approx 100 %); where in *R. microplus* shows moderate resistance (level II) against deltamethrin and against ivermectin, but susceptibility to cypermethrin. Moderate resistance against ivermectin is also recorded in *R. sanguineus*.



4.10 Fisheries Science

Fisheries science includes research in the areas of Fisheries Resource Management, Harvest and Post-Harvest Technology of fishes, Aquaculture, Fishery Hydrography and Fishery Engineering. Wave rider buoy deployed in sea near Okha by Fisheries Research Station, Okha under INCOIS, Hyderabad funded project, which provides information of ocean waves, currents, direction, wind velocity and speed. The SMS of the sea condition has been delivered at every 24 hours to the registered fishermen. Some valuable production of Seaweed Liquid Fertilizer (SLF) has been produced by Fisheries Research Station, JAU, Okha.



Table 4.10 Fisheries Production

Research Station	Particulars	Nos.
Fisheries Research Station, JAU, Sikka	Seed of pearl oyster (<i>Pinctada fucata</i>)	177.35 lakh
	Edible Oyster (<i>Crossostrea sp.</i>)	55 lakh
Fisheries Research Station, JAU, Okha	Seaweed Liquid Fertilizer (SLF)	1765 liters

Recommendation for Fish Farmers

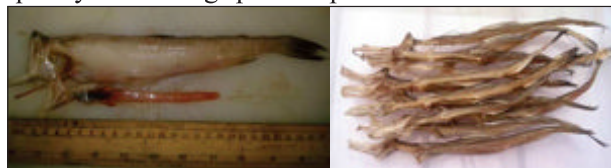
Effects of pro-biotics on survival, growth and biochemical changes in *Labeo-rohita* fry

Fish farmers are recommended to incorporate three probiotics *Lactobacillus subtilis* (15 x 10⁷ cfu/g), *Bacillus subtilis* (10 x 10⁷ cfu/g) and *Saccharomyces cerevisiae* (10 x 10⁷ cfu/g) in the ratio of 4:3:4 @ 3 % in fish feed to obtain higher growth, nutritive value and survival rate of *Labeo rohita* in rearing pond.



Effect of dressing on quality and shelf life of dried bombay duck (*Harpodon nehereus*) during storage

It is recommended to fish processors that removal of gill and gut in bombay duck (*Harpodon nehereus*) before sun drying may be adopted for better quality and storage period up to six months.



Effects of different salinities on growth and survival of juvenile Pacific white shrimp, *Litopenaeus vannamei* (Boone, 1931)

Shrimp farmers are recommended to use 30 ppt salinity water or select areas having such salinity water for higher growth and survival of shrimp *Litopenaeus vannamei*.



Effect of bottom sediments on moulting to *Fenneropenaeus merguensis* in circular cement tank

Shrimp farmers are recommended to culture *Fenneropenaeus merguensis* (Banana shrimp) with pond bottom of sea sand + mud (50:50) mixture of 6 inch sediment thickness, for better growth and survival rate.

Effects of gamma irradiation on the quality of sun-dried croaker (*Johnius dussumieri*)

The dry fish processors / exporters are recommended to apply dose of 5 kGy gamma irradiation to dry salted croaker (*Johnius dussumieri*) fish for better quality and nine months shelf life.

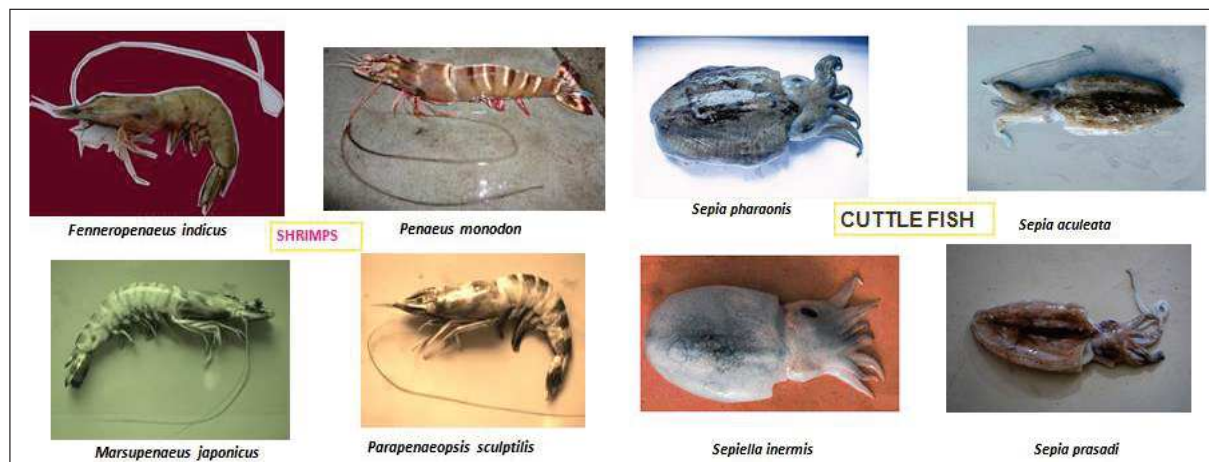


Recommendation for Scientific Community

Documentation and seasonal availability of commercially important shellfish species at Veraval fishing harbor

Twenty two shellfish species including shrimps, crabs, lobsters, squids, cuttlefish and octopus of different genera were recorded during October 2012 to May 2016 at fishing harbor of Veraval, Gujarat.

Group	Availability			
	2012-13	2013-14	2014-15	2015-16
Shrimps	Throughout the year. Less number in January and May.	September to February. Less number in March to May.	September to mid-December. Less number in January to May.	Less number throughout the year except November, December and March.
Crabs	Throughout the year except December.	Throughout the year except November, December and March.	Throughout the year.	Throughout the year except December and May.
Lobsters	Throughout the year.	Throughout the year.	Throughout the year.	Throughout the year.
Cephalopods (Cuttle fish, Octopus and Squid)	Throughout the year except May.	Throughout the year except after mid-April.	Throughout the year except May.	Throughout the year.



4.11 Social Science/ Home Science

Social science group consist of agricultural economics, agricultural statistics, extension education and home science.

Agricultural economists worked on different research projects viz. Farm cost studies of important crops in Gujarat state; Development of Optimal Crop Plans (OCPs) for Sustainable ground watermanagement practices in Saurashtra Region, Gujarat; Total Factor Productivity (TFP) of major crops and contribution of research investment to agricultural growth in Gujarat; Network Project on Market Intelligence and scheme for creating a permanent machinery for studying the cost of cultivation/ production of principal crops in Gujarat state. Price forecast different crops viz. groundnut, cotton, castor, cumin *etc.* were analyzed and for suggestions to farmers.

Recommendation for Scientific Community

Path coefficient analysis tools for selection of genotype in wheat

It is advised to scientific community, that the productive tillers per 3 meter, grain weight per spike and days to anthesis are the important biometric characters for selecting genotype for improving grain yield of timely shown wheat under South Saurashtra Agro-climatic Zone.

Total factor productivity of major crops and contribution of research investment to agricultural growth in Gujarat

The major crops of Gujarat have experienced a strong technological growth during last two decades, except bajra and sesamum. The internal rate of return to public investment in agricultural research ranged from 26.80 % in case of mustard to about 74.90 % (i.e. 75 %) for cumin with the overall average of 42 % for major crops of Gujarat. Sesamum needs more efficient technological breakthrough to increase productivity by evolving varieties which sustain in adverse monsoon conditions. Proper management of agronomical practices to keep low production cost and proper price incentive to keep pace with other crops in the state are equally important.

To attain targeted agricultural growth, investments on agricultural research and extension education need to be increased at the rate of 5 per cent per annum to achieve an additional one per cent growth in TFP.

4.12 Mega Seed Unit

At Mega Seed processing plant, the crop seeds produced in the farms were processed. The processed good quality seeds were sold to farmers under the brand name of "Sawaj Beej". Very good response was observed among the farmers to avail this facility.



Table 4.12.1 Production of truthful, foundation and certified seeds of field crops under mega- seed project

Sr. No.	Crops	Production (q)		
		Truthful	Foundation	Certified
1	Groundnut	796.56	412.20	1292.40
2	Chickpea	170.00	32.00	472.40
3	Sesame	64.73	-	-
4	Wheat	1167.25	-	-
5	Cotton	20.00	-	-
6	Castor	20.00	-	-
7	Cumin	28.00	-	-
8	Coriander	282.00	-	-
9	Soybean	129.88	-	-
10	Mungbean	35.00	-	-
11	Urdbean	67.82	3.00	-
12	Pigeon pea	120.00	14.00	876.80
13	Sugarcane setts	896.80	-	-
14	Sorghum	51.99	-	-
14	Fenugreek	00.40	-	-
15	Garlic	56.00	-	-
16	Onion	40.00	-	-
17	Fennel	3.00	-	-
18	Papaya seeds	0.50	-	-
19	Sunhemp	12.59	-	-
20	Dhaincha	8.34	-	-
	Total	3984.11	461.20	2641.60

The breeder seeds of different crops also produced to fulfill the demand of private and public sectors as per the national and state indents under coordination of Mega Seed unit and concern crop

scientist are given in following table. The required nucleus seeds of different crops were also produced for the breeder seed production in the ensuring season.

Table 4.12.2 Production of Nucleus / Breeder Seeds

Sr. No.	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total(q)
				National	State	
1	Groundnut	GG-2	-	-	57.60	57.60
		GG-5	1.75	-	21.00	22.75
		GG-7	0.83	-	29.10	29.93
		GJG-9	1.07	15.00	106.80	122.87
		GJG-31	-	16.80	-	16.80
		GG-8	-	17.40	-	17.40
		GG-20	2.10	-	1623.90	1626.00
		GJG-22	0.50	-	95.10	95.60
	GJGHPS-1	0.90	-	15.00	15.90	



Sr. No.	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total(q)
				National	State	
		GG-11	2.10	-	94.50	96.60
		GJG-17	2.65	-	94.50	97.15
		GAUG-10	-	-	24.60	24.60
		GJG-19	0.26	25.00	-	25.26
		GJG-18	0.28	20.00	-	20.28
		GG-16	-	6.00	-	6.00
		GG-21	-	41.40	-	41.40
		Sub Total	12.44	141.60	2162.10	2316.14
2	Pearl millet	Pearl millet	0.04	7.81	3.36	11.21
3	Sesame	G.Til-1	0.07	0.20	2.65	2.92
		G.Til-2	0.50	3.20	9.30	13.00
		G.Til-3	0.30	2.00	10.91	13.21
		G.Til-4	0.22	0.40	2.10	2.72
		GJT-5	0.03	-	0.15	0.18
		G.Til-10	0.07	2.00	1.30	3.37
		Sub Total	1.19	7.80	26.41	35.4
4	Chickpea	GG 1	2.18	-	19.90	22.08
		GG 2	2.25	-	26.50	28.75
		GJG 3	3.50	37.75	44.25	85.50
		GG 4	3.37	45.25	-	48.62
		GG 5	3.36	-	45.50	48.86
		Sub Total	14.66	83	136.15	233.81
5	Wheat	GW 366	12.60	282.40	33.20	328.20
		LOK-1	-	-	27.60	27.60
		GW-496	-	58.80	56.40	115.20
		Sub Total	12.60	341.20	117.20	471.00
6	Pigeon pea	GJP 1	0.32	1.50	30.00	31.82
		Grand Total	41.25	582.91	2475.22	3099.38

4.13 Production of Sawaj brand bio-agents and microbial products

The department of Plant Pathology has produced and provided *Sawaj* brand products like *Rhizobia*, *Azotobacter* and PSB liquid bio-fertilizer to the State Department of Agriculture for distribution to farmers as an integrated part of Krushi Mahotsav kits

and sold directly to farmers at reasonable price. The department has also produced and distributed bio-agent *Trichoderma harzianum* under the brand name *Sawaj-Trichoderma* for the management of various soil borne disease especially stem and pod rot of groundnut in the Saurashtra region.

Table 4.13.1 Production of Sawaj brand bio-agent and liquid bio-fertilizer

Sr. No	Name of Product	Quantity
1	<i>Sawaj-Trichoderma</i> (tonne)	105.20
2	<i>Sawaj-Rhizobium</i> (Bottle- 500 ml)	3255
3	<i>Sawaj-Azotobacter</i> (Bottle- 500 ml)	2991
4	<i>Sawaj-PSB</i> (Bottle- 500 ml)	4902



During the year 2016-17, various microbial agents e.g. viruses, bacteria, fungi, protozoans and nematodes are being used in IPM program. Among viral pathogens, nuclear polyhedrosis viruses of *Helicoverpa* (*HaNPV*), *Spodoptera* (*SINPV*),

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.

Table 4.13.2 Production of microbial agents, traps, lure etc.

Sr. No.	Name of product	Quantity
1	<i>Beauveria</i> (tonne)	144.53
2	HNPV (bottle 250 ml)	689
3	SNPV (bottle 250 ml)	394
4	Trichocard (Nos.)	450
5	Fruit fly traps (Nos.)	1574
6	Fruit fly lure for fruit crops (Nos.)	1656
7	Fruit fly lure for vegetable crops (Nos.)	296
8	Pheromone Trap (Nos.)	1,24,804
9	Pheromone Lure (Pink bollworm) (Nos.)	1,49,588
10	Pheromone Lure (<i>Heliothis</i>) (Nos.)	1462
11	Pheromone Lure (<i>Prodenia</i>) (Nos.)	65
12	Pheromone Lure (Brinjal shoot and fruit borer) (Nos.)	134

4.14 Others

Front Line Demonstration (FLD) conducted on farmers' field

Crop scientists have successfully organized front line demonstration on farmers' fields in addition to the FLDs organized by KVKs of JAU.

Table 4.14.1 Summary of information of improved varieties

Sr. No.	Crop	Improved variety	No. of FLDs	Total area under FLD (ha)	Yield in IP (q/ha)	Yield in FP (q/ha)	Increase in yield (%)
1	Groundnut	GJG-22	2	0.80	22.00	19.75	11.39
		GJG-17	2	0.80	22.75	20.50	10.98
		GJG-9	1	0.40	19.50	18.00	8.33
		JL-501	2	0.80	19.25	17.50	10.00
		GJG-31	5	2.00	19.60	17.85	9.80



Sr. No.	Crop	Improved variety	No. of FLDs	Total area under FLD (ha)	Yield in IP (q/ha)	Yield in FP (q/ha)	Increase in yield (%)
2	Wheat	GJW 463	5	2.00	60.25	55.20	9.15
		GW 451	5	2.00	46.25	44.75	3.35
3	Vegetable & Spices	Gujarat Coriander -2	17	6.80	12.66	10.55	19.95
		Guj. Cumin -4	6	2.40	11.14	9.38	18.69
4	Pearl millet	GHB 538	75	30	38.67	36.18	6.88
		GHB 732	75	30	44.10	41.08	7.47
		GHB 558	25	10	29.86	28.10	6.26
5	Sesame	G.Til-4	20	8.0	11.22	8.39	33.73

Table 4.14.3 Production of planting material of horticultural and other crops

Sr. No.	Planting Material	Production (Nos.)
1	Fruit crop graft	25149
2	Fruit crops saplings	14861
3	Seedlings	64662
4	Ornamentals & Medicinal plants	43987
	Total	148759

Table 4.14.4 Analysis of Soil & Irrigation Water Sample

Name of Research Station/ Department	Number of Samples		
	Soil	Irrigation Water	Plant
Department of Agriculture Chemistry & Soil Science	2608	2102	-
Department of Biotechnology & Biochemistry	366	155	55047
Main Dry Farming Research Station, Targhadia	550	45	240
Krishi Vigyan Kendra, Amreli	413	33	-
Krishi Vigyan Kendra, Jamnagar	563	59	74
Krishi Vigyan Kendra, Khapat - Porbandar	358	58	-
Krishi Vigyan Kendra, Nanakandhasar, Surendranagar	673	220	-
Total	5531	2672	55361

Table 4.14.5 New research programs sanctioned

Sr. No.	Agency	No. of Research Programs	Amount (Rs. in Lakh)
1	ICAR	01	300.00
2	Govt. of India	01	1.25
3	Govt. of Gujarat	06	206.07
4	Other Agencies	25	150.97
	Total	33	658.29

