

RESEARCH



Chapter - 4



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. The 20th Research Council meeting was organized on February 14, 2023 for approval of new research programs and research activities during the year.

Table 4.1: Members of 20th Agricultural Research Council meeting

No.	Name	Designation
1	Dr. V. P. Chovatia	Vice Chancellor, JAU, Junagadh
2	Dr. H. M. Gajipara	Director of Research & Dean PG Studies, JAU, Junagadh
3	Dr. H. M. Gajipara,	Director of Extension Education, JAU, Junagadh
4	Dr. S. J. Solanki	Director of Agriculture, GoG, Gandhinagar
5	Dr. P. M. Vaghasiya	Director of Horticulture, GoG, Gandhinagar
6	Dr. F. S. Thakar	Director of Animal Husbandry, GoG, Gandhinagar
7	Dr. S. G. Savalia	Dean, Faculty of Agriculture
8	Dr. N. K. Gontia	Dean, Faculty of Agricultural Engineering & Technology
9	Dr. D. K. Varu	Dean, Faculty of Horticulture
10	Dr. C. D. Lakhlani	Principal, PGIABM
11	Dr. P. Mohnot	Associate Director of Research
12	Dr. R. B. Madariya	Associate Director of Research
13	Dr. D. S. Hirpara	Associate Director of Research, JAU, Targhadia
14	Dr. B. A. Monpara	Convener - Crop Improvement AGRESCO Subcommittee
15	Dr. P. D. Kumawat	Convener - Crop Production AGRESCO Subcommittee
16	Dr. D. S. Kelaiya	Convener - Plant Protection AGRESCO Subcommittee
17	Dr. D. K. Varu	Convener - Horticulture & Forestry AGRESCO Subcommittee
18	Dr. H. D. Rank	Convener - Agril. Engineering AGRESCO Subcommittee
19	Dr. B. D. Savaliya	Convener - Animal Science AGRESCO Subcommittee
20	Dr. V. D. Tarpara	Convener - Social Science AGRESCO Subcommittee
21	Dr. H. P. Gajera	Convener - Basic Science AGRESCO Subcommittee
22	Dr. K. L. Dobariya	Retired Research Scientist
23	Dr. B. M. Dabhi	Retired Research Scientist
24	Dr. P. D. Kumavat	Research Scientist (Sugarcane), Kodinar
25	Dr. D. R. Mehta	Professor & Head (Genetics & Plant Breeding)
26	Dr. H. D. Rank	Professor & Head (Soil & Water Conservation Engineering)
27	Dr. B. D. Savaliya	Research Scientist (AGB), Cattle Breeding Farm
28	Shri Arjanbhai Naranbhai Chariya	Farmer

4.2 Planning and Monitoring Monitoring

The monthly and quarterly progress reports were collected from the concerned heads of the schemes which were compiled and submitted to the Government quarterly. The problems of the schemes were solved

satisfactorily by discussion between the scientists and the Director of Research in two meetings held during the month of November-2022 and February-2023 for evaluation of expenditure of planned schemes and reallocation of the funds, etc.



State Programs

Monitoring of research work is done through a defined 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 ADR, 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 Action Committee (two zones), twice in a

year, 2) Agricultural Research Subcommittee (nine discipline wise), 3) Joint Agricultural Research Subcommittee (one for all disciplines) and 4) Combined 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 State Government of Gujarat)**

Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
1	12002-00	Strengthening of Research in Millet	1986	Main 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	Pulses 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 Management in Fruit Crops	1997	Dept. of Entomology, Junagadh
12	12095-00	Strengthening of Horticulture Research & Development activities	1997	Dept. of Horticulture, Junagadh
13	12096-00	Research on Micro Irrigation System in Saurashtra Region	1997	Dept. of Agronomy, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
14	12131-00	Research on Eco-Friendly Biological Fertilizer	1997	Dept. of Pl. Patho., Junagadh
15	12712-5B	Campus Development Program (On Campus)	2004	Directorate of Res., Junagadh
16	12903-00	Establishing of Organic Farming Cell at Junagadh	2000	Dept. of Agronomy, Junagadh
17	12905-00	Proposal for Research on Watershed Management	2000	MDFRS, Targhadia; GRS, Dhari & Dept. of SWCE, CAET, Junagadh
18	12907-00	Strengthening of Agro-Meteorology at JAU	2000	PMRS, Jamnagar & ARS Mahuva
19	12930-00	Establishment of New Sub-Center for Research on Cumin	1998	Agriculture School, Halvad
20	12931-00	Establishment of New Research Centre on Onion Crop	2003	Vegetable Research Station, Junagadh & FRS, Mahuva
21	12573-00	Research on Tillage Technology	2006	Dept. of Agronomy, Junagadh
22	12574-00	Research on Rejuvenation of Degraded Coastal Agro-Eco Systems of Saurashtra	2006	Research Training & Testing Centre, Junagadh
23	12575-00	Strengthening Research in Sesamum	2006	Agril. Res. Station, Amreli
24	12101-01 to 04	Centre of Excellence on Soil and Water Management	2006	RTTC, Junagadh; MDFRS, Targhadia; ARS (FC), Mahuva & FRS, Mangrol
25	12576-00	Research on Post-Harvest Technology of Important Crops of Saurashtra	2006	Dept. of Processing & Food Engg., CAET, Junagadh
26	12582-00	Strengthening of Research on Genetically Modified Cotton	2009	Cotton Research Station, Junagadh
27	12583-00	Strengthening of Wheat Research	2009	Wheat Res. Station, Junagadh
28	12584-00	Strengthening Research on Castor	2009	Main Oilseeds Research Station, Junagadh
29	12585-00	Strengthening Research in Sugarcane	2009	Sugarcane Res. Stat., Kodinar
30	12586-00	Strengthening of Research in Plantation and Fruit Crops at A.R.S. (Fruit Crops)	2009	Agricultural Research Station (FC), Mahuva
31	12587-00	Conservation of Plant Biodiversity	2009	Dept. of Genetics & Plant Breeding, Junagadh
32	12588-00	Development of Arid and Semi-Arid Fruit Crops	2009	Dept. of Horti., Junagadh
33	12590-00	Establishment of Bt Cotton Research Centre at Surendranagar District	2011	Cotton Research Station, Kukada
34	12014-00	Establishment of Spices Research Centre at Junagadh	2011	Vegetable Res. Stat., Junagadh
35	12015-00	Establishment of Bio-Fertilizer Unit at Junagadh	2011	Dept. of Plant Pathology, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
36	12018-00	Establishment of Research Centre on Onion at Talaja Dist.: Bhavnagar	2011	Agriculture Research Station, Talaja
37	12019-00	Strengthening of Dry Farming Research at Jam Khambhaliya	2012	Dry Farming Research Station, JamKhambhaliya
38	12020-00	Strengthening of Dry Farming Research at Vallbhipur	2012	Dry Farming Research Station, Vallbhipur
39	12021-00	Establishment of Mango Res. Project at Talala	2012	Dept. of Horti., Junagadh
40	12022-00	Project on Mega Seed for Quality Seed Production & Distribution	2012	Dept. of Seed Science & Tech., Junagadh
41	12023-00	Micronutrients and Sulphur Research in Soils and Plants in Saurashtra Region	2012	Dept. of Ag. Chemistry & Soil Science Junagadh
42	12024-00	Centre of Remote Sensing and Geoinformatics in Agriculture	2012	Dept. of Soil & Water Consr. Engg., CAET, Junagadh
43	12025-00	Recycling of Organic Waste for Sustainable Soil Productivity under Dry Land Agri. at Targhadia	2012	Main Dry Farming Research Station, Targahdia
44	12026-00	Project For Research on Forage Crop Production at Dhari	2012	Grassland Res. Station, Dhari
45	12028-00	Aflatoxin and Its Management in Groundnut in Saurashtra Region of Gujarat	2013	Main Oilseed Research Station, Junagadh
46	12029-00	Molecular Mapping of Important Traits and their Transfer Through Marker Assisted Selection (MAS) in Groundnut and Cotton	2013	Dept. of Biochemistry, Junagadh
47	12030-00	Studies on Effect of Climate Change on Fruit Crops of Saurashtra Region	2013	Dept. of Horticulture, Junagadh
48	12303-05	Establishment of Gir Cattle & Jaffrabadi Buffaloes	1996	Cattle Breeding Farm, Junagadh
49	12953-00	Strengthening of Livestock & Veterinary Component	2002	Cattle Breeding Farm, Junagadh
50	12303-14	Integrated Farming System (Integrated Farming Combining Crop Livestock Bio Resources)	2009	Cattle Breeding Farm, Junagadh
51	12303-15	Establishment of Bull Mother Farm of Gir Cattle & Jaffrabadi Buffaloes	2011	Bull Mother Farm, Amreli
52	12950-00	Establishment and Development of Research in Fisheries	2000	Fisheries Res. Station, Okha
53	12578-00	Establishment of Inland Fishery Research Centre	2006	Inland Fisheries Research Station, Junagadh
54	12579-00	Establishment of Pearl Oyster Hatchery	2009	Fisheries Res. Station, Sikka
55	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



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
56	12016-00	Establishment of Aqua-Based Research and Training Centre in Coastal Saurashtra at Mahuva	2011	Agricultural Research Station (FC), Mahuva
57	12031-00	Crop Improvement in Papaya at Junagadh	2014	Dept. of Horticulture, Junagadh
58	12032-00	Integrated Pest Management in Seed Spices at Junagadh	2014	Dept. of Entomology, Junagadh

(B) Non-plan Scheme (Sponsored by State Government of Gujarat)

Sr. No.	Budget Head	Name of Program	Sanction Year	Location
1	3226	Scheme of design experiment	1980	Dept. of Agril. Stat., Junagadh
2	5002	Scheme for research in bajra	1985	Main Pearl millet Research Station, 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	Pulses Research Station Junagadh
6	5008	Scheme for oilseed research	1962	Main Oilseed Res. Stat., Junagadh
			1973	Agril. Research Station, Amreli
	5008	Scheme for oilseed research	1985	Main Pearl millet Research Station, Jamnagar
			1979	Sugarcane Res. Station, Kodinar
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
9	5012	Scheme for research in grasses forage	1985	Grassland Res. Station, Dhari
10	5013	Strengthening of res. in vegetable (Tomato)	1962	Vegetable Res. 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



Sr. No.	Budget Head	Name of Program	Sanction Year	Location
16	5042	Strengthening of dry farming research station	1965	Dry Farming Res. Station, Ratia
			1979	Main Dry Farming Research Station, Targhadia
			1967	Dry Farming Research Station, JamKhambhalia
			1964	Dry Farming Res. Stat., Vallbhipur
			2011	Cotton Res. Stat., JAU, Kukada
			1975	Grassland & Agril. Res. Stat., Dhari
			1947-48	Dept. of Seed Science & Tech., Junagadh
			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	Research, Testing & Training Centre, Junagadh
20	5075	Establishment of seed technology cell	1981	Directorate of Research, Junagadh
21	7082-A	National agriculture research project	1987	Main Oilseed Res. Stat., Junagadh
	7082-B	National agriculture research project	1995	Dry Farming Research Station, Jam-Khambhaliya
	7082-B	National agriculture research project	1988	Main Pearl millet Research Station, Jamnagar
	7082-C	National agriculture research project	1982	Grassland Research Station, Dhari
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 and Extension Action Committee (ZREAC)

This committee is functioning at Zonal level of South Saurashtra and 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 necessary 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 2022-23, four meetings of ZREAC were organized; two each at Junagadh and Targhadia. **In the ZREAC meetings, seven crop varieties; 38 farmers' recommendations; 25 scientific**

recommendations and 90 new technical programs were approved (Table 4.2.2). The feedbacks as well as suggestions were also received from the officers of line departments and KVKs.

Table 4.2.2: Zonal Research Extension Action Committee (ZREAC) meeting

Meeting	Place	Date	No. of Recommendations approved		New Technical Programs
			Farmers	Scientific	
37 th ZREAC (<i>Rabi-summer</i>) of South Saurashtra Agro-climatic Zone	Junagadh	October 11-12, 2022	04*+11	07	32
37 th ZREAC (<i>Rabi-summer</i>) of North Saurashtra Agro-climatic Zone	Targhadia	November 10, 2022	01*+02	-	03
38 th ZREAC (<i>kharif</i>) of South Saurashtra Agro-climatic Zone	Junagadh	January 19-20, 2023	02*+19	15	39
38 th ZREAC (<i>kharif</i>) of North Saurashtra Agro-climatic Zone	Targhadia	January 21, 2023	06	03	16
Total			07*+38	25	90



Agricultural Research Sub Committee (AGRESCO – Discipline-wise)

There are nine 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 of the region
Crop Production	Agronomy, Agricultural Chemistry & Soil Science, Weed Control
Plant Protection	Entomology & Plant Pathology
Horticulture	Fruits Science, Vegetables Science, Floriculture & Landscape Architecture, Post-Harvest Technology
Agricultural Engineering	Soil & Water Conservation Engineering, Farm Machinery & Power Engineering, Renewable Energy Engineering, Processing & Food Engineering, Irrigation & Drainage Engineering
Basic Science	Biochemistry, Biotechnology, Plant Physiology, Plant molecular Biology
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 discuss the new technical programs as well as the recommendations for farmers and scientific community. The scientists presenting the results of various schemes/ projects will refine the reports, recommendations and new technical programs for next

season. The suggestions made in the meetings are incorporated in the reports. Each and every proposal and program pertaining to the various disciplines are discussed critically. The conveners of various sub committees present the proceedings in the Joint AGRESCO meeting.

Various Agricultural Research Sub Committee meetings were held during February to March 2023 at Junagadh. **Seven new crop varieties, 37 farmers' recommendations, 31 scientific recommendations and 83 new technical programs were approved.** The reports of the work carried out at various research schemes of the university were also presented and approved.



Table 4.2.4 Various 19th AGRESKO (Discipline wise) subcommittee meetings organized

Sub Committee	Date	No. of Recommendations		New Technical Programs	On-going Research Projects
		Farmers	Scientific		
Social Science	February 13, 2023	-	13	04	12
Basic Science	February 15-16, 2023	01	04	06	27
Agricultural Engineering	February 20-21, 2023	10	04	11	25
Horticulture & Forestry	February 22, 2023	06	01	14	22
Plant Protection	February 27-28, 2023	05	05	25	316
Crop Production	March 01-02, 2023	15	03	22	132
Crop Improvement	March 09-10, 2023	07*	01	01	-
		07*+37	31	83	-

*No. of crop varieties 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 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 19th Combined AGRESKO of State Agricultural Universities.



The 19th Joint AGRESKO meeting of JAU was held at College of Agriculture, JAU, Junagadh on March 24, 2023 under the chairmanship of Dr. V. P. Chovatia, Hon'ble Vice Chancellor, JAU, Junagadh. All AGRESKO conveners of various committees presented their reports and approved. **Seven new crop varieties; 36 farmers' recommendations; 29 scientific recommendations and 92 new technical**



programs were approved in the meeting. recommendations; 29 scientific recommendations and 92 new technical programs were approved in the meeting.

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

This is the apex body to finalize the research recommendations as well as the new technical



programs at state level. The meeting is held at the venues in the rotational mode. The members of this committee include Hon'ble Vice Chancellors, Directors of Research, Directors of Extension Education, Associate Directors 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 also the members of the committee. 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 sub-committee 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 19th Combined Meeting of Agricultural Research Council (AGRESKO-2023) of SAUs and Kamdhenu University was held through virtual mode, organized and hosted by Anand Agricultural University, Anand during April 25 to May 17, 2023. Shri Raghavjibhai Patel, Hon'ble Minister, Agriculture, Animal Husbandry and Cow Breeding, GoG graced the plenary session. Hon'ble Vice Chancellors of JAU, AAU, NAU, SDAU and KU namely Dr. V. P. Chovatia, Dr. K. B. Kathiria, Dr. Z. P. Patel, Dr. R. M. Chauhan and Dr. N. H. Kelawala remained present during the meeting.



During 19th Combined AGRESKO meeting, seven new crop varieties viz. Chickpea (GG 8 and GKG 2), Mungbean (GM 10), Garlic (GG 8), Coriander (G.Cr. 4), Endorsement of Cotton (G.Cot.46) and Sesame (G.Til 8) of JAU were recommended for release in the state. Besides, 36 technologies/ recommendations were

made for farmers and 26 recommendations were made for scientific community. In addition, as many as 82 new technical programs were formulated to initiate the new research programs for the solutions of the applied and basic problems of agriculture and allied fields.

Table 4.2.5: 19th Combined AGRESKO meeting of SAUs

Sub Committee	No. of Recommendations		New Technical Programs
	Farmers	Scientific	
Crop Improvement	07*+01	-	02
Crop Production	15	03	20
Plant Protection	05	05	30
Horticulture & Forestry	04	01	10
Agricultural Engineering	10	04	11
Basic Science	01	04	05
Social Science	-	09	04
Total	07*+36	26	82

*No. of crop varieties released

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 of India are being organized. Total 17 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 presents 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 Junagadh Agricultural University

Name of Project	Department/ Research Station	Date of Monitoring	Name and designation of member of monitoring
AICRP on Soybean	Agricultural Research Station, JAU, Amreli	September 18, 2022	Dr. G. K. Satpute, Principal Scientist (Genetics & Plant Breeding) and Dr. Raghavendra Madar, Scientist (Agronomy), IISR, Indore.
STR-AICRP on Seed (Crops) project	Main Pearl millet Research Station, JAU, Jamnagar	September 29, 2022	1. Dr. Rakesh K. Kapila, Convener, CSK, HPKV, Palampur 2. Dr. Manish Wakode, Member, PDKV, Akola 3. Dr. Vinitha amtekey, Member, ICAR-IISS, Mau
AICRP on Groundnut	Main Oilseeds Research Station, JAU, Junagadh	October 09-10, 2022	1. Dr. K. S. S. Naik, Principal Groundnut Breeder and Dr. Vemana, Pathologist, Agril. Research Station, Kadiri 2. Dr. P. Maheswar Reddy, Regional Agril. Research Station, Tirupati 3. Dr. Jogendra Singh, Regional Agril. Research Station, Durgapur, Jaipur
AICRP on Cotton	Cotton Research Station, JAU, Junagadh	November 09-10, 2022	1. Dr. S. Manickam, Principal Scientist; Dr. K. Rathinavel, Principal Sci.; Dr. K. Rameash, Principal Sci. and Dr. A. Sampath Kumar, Senior Sci., ICAR-CICR, Coimbatore 2. Dr. K. Thirukumaran, Assoc. Professor (Agronomy), TNAU, Coimbatore 3. Sh. Shrirang Wanjarwadekar, M/s. Mahyco Pvt. Ltd.
AICRP on Pigeon pea	Pulses research Station, JAU, Junagadh	December 17-18, 2022	Dr. Rachappa V. Haveri, Sr. Sci.(Ento.) and Principal Sci. & I/c AICRPP; Dr. S Muniswamy, Sr. Sci.(Pl. Br.); Dr. Anand Police Patil, Sci. (Agron.) and Dr. Pampannagouda, Sci. (Microbio.), Agril Res. Station, Gulbarga
AICRP on Castor	Main Oilseeds Research Station, JAU, Junagadh	December 24-25, 2022	1. Dr. Yamanura, Jr. Breeder and Dr. R. Mohan Kumar, Agronomist, ZARS, GKVK Campus, UAS, Bangalore 2. Dr. M. Santhalakshmi Prasad, Principal Scientist & Co-PI (Plant Pathology), ICAR-IIOR, Hyderabad
AICRP on Chickpea	Pulses research Station, JAU, Junagadh	January 30-31, 2023	1. Dr. N. S. Kute, Principal Scientist & I/c AICRP on Chickpea and Dr. S. B. Latake, Scientist (Plant Pathology), MPKV, Rahuri 2. Dr. Brij Nandan, Principal/Chief Scientist (Agronomy), PI (NFSM), SKUAST-Jammu

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	Main Pearl millet Research Station, Jamnagar
2	2004-00	AICRP on Wheat	1987	Wheat Res. Station, Junagadh
3	2008-01G	AICRP on Groundnut	1987	Main Oilseed Res. Station, Junagadh
4	2008-1C	AICRP on Castor	1968	Main Oilseed Res. Station, Junagadh
5	20-1SM	AICRP on Sesame	1986	Agricultural Res. Station, Amreli
6	2009-00	AICRP on Cotton	1967	Cotton Research 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 Agri. 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	Main Dry Farming Research Station, Targhadia
12	2076-02	AICRP on BSP-NSP seed technology research	1984	Main Pearl millet Research Station, Jamnagar
13	2258-00	AICRP on Post-harvest Engineering & 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 Plasticulture Engineering & Technologies	2005	Dept. of Renewable Energy Engg., CAET, Junagadh
17	2258-A	AICRP on Ground water utilization	2004	Dept. of Soil & Water Conservation Engg., CAET, Junagadh
18	2305-03	Network project on buffalo	2001	Cattle Breeding Farm, Junagadh
19	2303-08	Gir germplasm unit	2009	Cattle Breeding Farm, Junagadh
20	2303-09	Gir data recording unit	2009	Cattle Breeding Farm, Junagadh

External Funded Research Projects

The university is also undertaking various external funded 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 External Funded Research Projects functioning in the university

Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
1	18005-10	Genetically enhanced micronutrient-dense pearl millet grains for improved human nutrition in the India	2010	ICRISAT, Hyderabad	Main Pearl millet Research Station, Jamnagar
2	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
3	18005-04, 05 & 15	Agricultural demonstration activities in SSP command area Phase-II	2010	SSNNL, Govt. of Gujarat	DFRS, Vallbhipur, Agri. School, Halvad and Cotton Research Station, Kukada
4	18005-18	Establishment of model organic farm	2015	GoG	Dept. of Agron., Junagadh
5	18005-01	Experimental agro-met advisory services	1996	GOI	Dept. of Agron., Junagadh / MDFRS, Targhadia
6	18126-02	Centrally sponsored scheme (Spices)	2006	GoI	Vegetable Research Station, Junagadh
7	18127-00	Seed production in agricultural crops and fisheries	2006	GoI	(Oilseed-Megaseed) Junagadh
8	18127-00	Seed production in agril. crops and fisheries (Oilseeds-Megaseeds)	2006	GoI	Main Oilseed Research Station and Dept. of Seed Sci. & Tech., Junagadh
9	18803-01 to 12	Megaseed revolving fund	2006		
10	18804-01 to 04	Seed production in agricultural crops	2006		
11	18005-06	Forecasting agricultural output using space, agro meteorology and land based observations (FASAL)	2011	GoI	Dept. of Agronomy, Junagadh
12	2012	All India network research project on onion and garlic	2009	ICAR-Network	Vegetable Research. Station, Junagadh
13	2030-2	Soil test based fertilizers application for targeted yield of Bt cotton in Saurashtra region of Gujarat	2010	ICAR-Network	Dept. of Agri. Chem. & Soil Science, Junagadh
14	2042-02	National initiative on climate resilient agriculture - dry land	2011	ICAR-Network	Main Dry Farming Res. Station, Targhadia
15	2002-5	Implementation of protection of plant varieties and farmer's rights legislation	2002	ICAR-Network	Main Pearl millet Res. Station, Jamnagar



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
16	2004-1	Project for frontline demonstration in wheat		ICAR-Network	Wheat Research Station, Junagadh
17	2008-3	Project for frontline demonstration in sesame	2007	ICAR-Network	Agriculture Research Station, Amreli
18	2008-12	Scheme for breeder seed production of oilseeds crops (ICAR revolving fund)	2007	ICAR-Network	Main Oilseed Research Station, Junagadh
19	2009-6	Front line demonstration on cotton	2001	ICAR-Network	Cotton Research Station, Junagadh
20	2254	Study storage losses of food grains	2013	ICAR-Network	Dept. of PFE, CAET, Junagadh
21	2374-1	FLD on Chickpea	-	ICAR-Network	Pulses Research Station, Junagadh
22	2374-6	FLD on Pigeon pea			
23	2504-00	Revolving fund horticulture (Nursery)	-	ICAR-Network	Dept. of Horticulture, Junagadh
24	2704-40	Project for frontline demonstration on groundnut	1999	ICAR-Network	Main Oilseed Res. Station, Junagadh/ Agril. Research Station, Amreli
25	2704-43	Project for frontline demonstration in pearl millet	1989	ICAR-Network	Main Pearl millet Research Station, Jamnagar
26	2002-07	Consortia research platform (CRP) on biofortification	2014		
27	18132	Creation of seed-hubs for increasing indigenous production of pulses in India	2016	ICAR-Network	Dept. of Seed Science & Tech., Junagadh
28	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
29	18009-33	Proliferation of Bt-gene in native cotton varieties of Gujarat	2017	GoG	Cotton Research Station, Junagadh
30	2009-09	Testing of Bt. Cotton	2017	ICAR	Cotton Res. Stat., Junagadh
31	18246-91	River flow simulations integrating satellite data in forested catchment	2017	GoG	CAET, JAU, Junagadh
32	18009-34	Seed infrastructure under NMOOP	2017	GoG	Agril. Res. Station, Amreli
33	1855-03	Mapping and valuation of economics, social and environmental benefits of conserving Gir Forest area	2018	GoG	Dept. of Economics, JAU, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
34	2009-07	Insecticide Resistance Management: Dissemination of pink bollworm management strategies	2018	ICAR	Cotton Research Station, JAU, Junagadh
35	18132-02	Creation of seed-hubs for enhancing quality seeds availability of major oilseeds crops - groundnut under NFSM - NMOOP	2018	GoI	Department of Seed Science & Technology, JAU, Junagadh
36	2008-08	Project for production of breeder seed of annual oilseeds crops.	1987	ICAR	Main Oilseed Research Station, JAU, Junagadh
37	2260-3	Development of protocols for procurement, safe storage and milling outturn of major pulses	2019	ICAR	Dept. of Processing & Food Engineering, CAET, JAU, Junagadh
38	2008-19	Mainstreaming of Sesame germplasm for productivity enhancement through genomics assisted core development and trait discovery	2020	ICAR	Agricultural Research Station, JAU, Amreli
39	18247-35	Product testing for pesticides residue to promote organic farming and export of Agricultural produce (RKVY)	2019	GoG	Dept. of Biotechnology, JAU, Junagadh
40	18247-36	Seed Replacement Rate Enhancement for the year 2019-20 (RKVY)	2019	GoG	Dept. of Seed Science & Tech., JAU, Junagadh
41	18274-37	Centre of Excellence for quality testing of cotton (RKVY)	2019	GoG	Cotton Research Station, JAU, Junagadh
42	18247-39	Production of value added cow based by product to sustain Gaushalas (RKVY)	2019	GoG	Cattle Breeding Farm, JAU, Junagadh
43	18247-41	Commercial Exploitation of Date palm through Tissue culture	2019	GoG	Dept. of Genetics & Plant Breeding, JAU, Junagadh
44	18247-43	Strengthening of seed multiplication farm (RKVY)	2019	GoG	Dept. of Seed Science & Tech., JAU, Junagadh

4.3 Crop Improvement

Crop Improvement includes development of new crop varieties and maintenance of germplasm of mandate crops of the region.

The breeder seeds of different crops were produced to fulfill the demand of private and public

sectors as per the national and state indents under coordination of 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 ensuing season

Table 4.3.1 Production of Nucleus / Breeder Seeds

Sr. No.	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
1	Groundnut	GG-2	3.60	-	44.70	48.30
		GG-5	3.50	-	30.00	33.50
		GG-7	3.20	15.10	10.20	28.50
		GG-8	3.60	-	-	3.60
		GJG-9	15.55	200.10	150.00	365.65
		GJG-31	12.30	75.00	65.10	152.40
		GJG-32	100.00	1000.20	3325.50	4425.70
		GJG-33	2.10	10.20	29.10	41.40
		GAUG-10	5.70	50.10	20.10	75.90
		GG-11	9.00	-	144.00	153.00
		GG-16	3.60	-	-	3.60
		GJG-17	6.00	-	278.10	284.10
		GJG-18	2.10	1.20	9.00	12.30
		GJG-19	5.00	-	0.00	5.00
		GG-20	90.20	70.10	870.00	1030.30
		GG-21	3.00	0.00	13.20	16.20
		GJG-22	160.27	400.20	1678.80	2239.27
		GG-23	5.80	-	-	5.80
		GG-35	9.80	-	-	9.80
		GJG HPS-1	2.80	-	23.10	25.90
		GJG HPS-2	1.75	53.10	10.20	65.05
		GG-37	9.90	0.00	21.10	31.00
		SB-XI	0.06	0.00	0.00	0.06
J-87	0.30	0.00	0.00	0.30		
GJG-41	4.20	-	12.00	16.20		
		Sub Total	463.33	1875.3	6734.2	9072.83
2	Pearl millet	GHB 1225	0.012	-	2.15	2.162
		GHB 1129	0.055	-	4.15	4.205
		GHB 1231	0.076	-	0.8	0.876
		GHB 719	0.008	-	0	0.008
		GHB-744	0.006	-	0	0.006
		GHB-905	0.015	-	0	0.015
		GHB 538 Improved	0.006	-	1.25	1.256

Sr. No.	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
		GHB 732	0.009	-	0.76	0.769
		Sub Total	0.187	-	9.11	9.297
3	Sesame	G.Til 1	0.10	-	0.50	0.60
		G.Til 2	0.50	1.00	1.08	2.58
		G.Til 3	0.30	0.20	1.90	2.40
		G.Til 4	0.20	0.75	0.00	0.95
		GJT 5	0.30	1.18	5.62	7.10
		G.Til 6	0.50	1.29	2.83	4.62
		G.Til 10	0.20	-	1.50	1.70
		G.Til 11	0.10	0.65	-	0.75
		Sub Total	2.20	5.07	13.43	20.70
4	Chickpea	GG 1	1.21	-	17.75	18.96
		GG 2	4.10	-	5.00	9.10
		GJG 3	7.80	125.00	-	132.80
		GG 4	0.38	-	-	0.38
		GG 5	9.23	14.25	85.00	108.48
		GJG 6	2.88	59.00	50.00	111.88
		GG 7	2.88	25.00	-	27.88
		GKG 1	1.19	-	5.00	6.19
		Sub Total	29.67	223.25	162.75	415.67
5	Pigeon pea	GJP 1	0.20	0.10	4.90	5.20
		Sub Total	0.20	0.10	4.90	5.20
6	Black gram	GU 1	1.80	0.10	1.90	3.80
		Sub Total	1.80	0.10	1.90	3.80
7	Wheat	GW 366	3.50	52.00	1.40	56.90
		GJW463	3.70	11.20	55.60	70.50
		GW 496	-	-	53.00	53.00
		Lok 1	-	-	26.00	26.00
		Sub Total	7.20	63.20	136.00	206.40
Grand total						9733.90

*Estimated Production data

The crop seeds produced in the farms were processed at Megaseed processing plant. The processed good quality truthful/ certified/ foundation seeds were

sold to farmers under the trade name of "Gir Sawaj" and its detail is given in below table. Very good response was observed among the farmers to avail this facility.

Table 4.3.2 Production of ‘Gir Sawaj’ brand truthful, foundation and certified seeds of field crops under Mega- Seed and Seed Hub projects

Sr. No.	Crops	Production (q)		
		Truthful	Foundation	Certified
1	Groundnut	584.60	95.55	2217.25
2	Chickpea	616.40	56.00	1076.80
3	Sesame	8.99	-	-
4	Wheat	1236.50	38.40	-
5	Cotton	46.00	-	-
6	Castor	72.00	-	-
7	Cumin	12.00	-	-
8	Coriander	30.00	-	-
9	Soybean	452.65	-	-
10	Mungbean	8.00	-	-
11	Urdbean	60.75	-	-
12	Pigeon pea	76.80	15.00	232.00
13	Sugarcane Setts	1400.00	-	-
14	Sorghum	3.50	-	-
Total		4608.19	204.95	3526.05
		Grand Total		8339.19

4.3.1 New crop varieties

Total seven new crop varieties viz. Chickpea (GG 8 and GKG 2), Mungbean (GM 10), Garlic (GG 8), Coriander (G.Cr. 4), Endorsement of Cotton (G.Cot.46) and Sesame (G.Til 8) of JAU were recommended for release for the benefit of the farmers during the year 2022-23.

4.3.1.1 Chickpea (Mechanical Harvesting): Gujarat Gram 8 (GG 8: Sorath Vikram)

The farmers of Gujarat state growing chickpea under irrigated and rainfed conditions are recommended to grow Gujarat Gram 8 (GG 8: Sorath Vikram). This variety is suitable for mechanical harvesting as it possesses plants with more height and erect growth habit. This variety has produced 2814 kg/ha seed yield which was 25.3, 26.3, 12.8, 75.5 and 43.8 per cent higher over check varieties Dahod Yellow, GG 1, GG 5, NBcG 47 and JG 24, respectively under irrigated condition. Under un-irrigated condition, it recorded 2017 kg/ha seed yield, which was 25.5, 30.4, 16.9, 11.9 and 24.5 per cent higher over GG 1, GG 2, GJG 3, GJG 6 and JG 24, respectively. Seeds of this

variety are of medium size and brown in colour. This variety is resistant to wilt and stunt diseases and showed low pod borer damage. This variety has higher iron content as compared to the check varieties.



4.3.1.2 Kabuli Chickpea: Gujarat Kabuli Gram 2 (GKG 2: Sorath Kabuli 2)

The farmers of Gujarat state growing *kabuli* chickpea under irrigated condition are recommended to grow early maturing variety Gujarat Kabuli Gram 2 (GKG 2: Sorath Kabuli 2). It recorded 2117 kg/ha seed yield, which was 29.1, 16.5 and 24.8 per cent higher over check varieties KAK 2, JGK 1 and PG 0517, respectively. Seeds of this variety are of large size (35.8 g/100 seeds). This variety showed resistant reaction against wilt and stunt diseases with low pod borer damage. It has higher dhal recovery (67.45 %), iron (63.58 ppm) and zinc (38.68 ppm) content than check varieties KAK 2, JGK 1 and PG 0517.



4.3.1.3 Mungbean: Gujarat Mung 10 (GM 10: Sorath Moti)

The farmers of Gujarat state growing mung in *kharif* season are recommended to grow early (65 days) maturing variety Gujarat Mung 10 (GM 10: Sorath Moti). This variety has produced 1036 kg/ha seed yield, which was 12.8, 15.0, 20.8, 4.5 and 11.1 per cent higher over check varieties GM 4, GAM 5, Meha, GM 6 and GM 7, respectively. Seeds of this variety are of medium in size and greenish in colour. This variety is resistant to MYMV, leaf curl, anthracnose and powdery mildew diseases.



4.3.1.4 Garlic: Gujarat Garlic 8 (GG 8: Sorath Mohini)

The farmers of Gujarat state growing garlic crop during *rabi* season are recommended to grow variety Gujarat Garlic-8 (GG-8: Sorath Mohini). This variety recorded 87.26 q/ha bulb yield, which was 16.4, 20.7, 22.1 and 22.1 per cent higher over the check varieties GJG-5, GAG-6, GG-7 and G-282, respectively. The bulb of this variety contains higher Total soluble solids (40.36 %), Pyruvic acid (2.98 mg/g), Carotenoids (0.82 mg/ 100 g), Reducing sugar (2.34 %), Ascorbic acid (9.42 %), True protein (3.13 %), Total carbohydrate (27.32 %) and Phenol (38.12 %) as compared to all the check varieties. The bulbs are medium in size, compact and creamy white in colour with purple tinch. The variety also reported low infestation of thrips and moderately susceptible to diseases.



4.3.1.5 Coriander :Gujarat Coriander 4 (G. Cor 4: Sorath Sugandha)

The farmers of Gujarat state growing coriander crop during *rabi* season are recommended to grow Gujarat Coriander 4 (G. Cor 4: Sorath Sugandha). It has recorded the mean seed yield of 2083 kg/ha, which was 17.3 and 8.6 per cent higher over check varieties; Gujarat Coriander 2 and Gujarat Coriander 3, respectively. The seeds of G. Cor 4 are medium in size, oblong in shape and brown in colour. This variety has early maturity and excellent aroma in seed due to higher Linalool content (68.80 %) in volatile oil. This variety was moderately resistant to aphid and resistant to powdery mildew disease as compared to check varieties.



4.3.1.6 Endorsement Cotton: Gujarat Cotton 46 (G. Cot 46: Sorath Swet Hem)

The farmers of Gujarat state growing Non *Bt* cotton (*Gossypium hirsutum* L.) are recommended to grow cotton variety Gujarat Cotton 46 (G.Cot 46: Sorath Swet Hem) under irrigated condition. This variety has recorded 2121 kg/ha seed cotton yield which was 27.7, 26.6, 27.7 and 15.1 per cent higher over check varieties viz., G.Cot 20, GN.Cot 22, GN.Cot 32 and Phule Yamuna, respectively. This variety gave lint yield of 812 kg/ha which was 48.5, 43.2, 35.5 and 33.4 per cent higher over check varieties viz., G.Cot 20, GN.Cot 22, GN.Cot 32 and Phule Yamuna, respectively. It possesses 36.7 % ginning outturn. It is found moderately resistant to *alternaria* leaf spot and bacterial leaf blight disease and also against sucking pests.



[Action: Research Scientist (Cotton), Cotton Research Station, JAU, Junagadh]

4.3.1.7 Sesame: Gujarat Til 8 (G. Til 8: Sorath Ratna)

The farmers of Gujarat state growing sesame in summer season are recommended to grow Gujarat Til 8 (G. Til 8: Sorath Ratna). The variety recorded seed yield of 1318 kg/ha which was 10.6 and 15.5 per cent higher over the check varieties G. Til 3 and GJT 5, respectively. Seeds of this variety are white and bold;

and it contains 48.44 % oil. This variety showed lower incidence of stem and root rot, phyllody diseases and thrips infestation.



4.3.2 Recommendation for Farmers Assessment of best practices for storage of turmeric planting material

The farmers of Saurashtra region growing turmeric are recommended to store the rhizomes of turmeric from their produce for six months storage *i.e.* from January to June to be used as planting material in next season should be stored under tree shed in soil pit (1m deep and 0.5 m width and 0.5 m length for 4 kg). It showed maximum germination per cent with higher number of healthy rhizomes.



4.4 Crop Production

Crop Production group mainly includes Agronomy, Agricultural Chemistry & Soil Science and Weed Control. Recommendations related to nutrient management, cultural practices, irrigation management and weed management are the different aspects of crop production.

Analysis of soil, irrigation water and plant is carried out with well-equipped laboratories at Department of Biotechnology, Agricultural Chemistry and Krishi Vigyan Kendras (KVKs) of JAU at reasonable price and its detail is given below.



Table 4.4.1 Analysis of Soil, Plant and Irrigation Water Sample

Sr. No.	Detail	No. of Sample analyzed
1	Soil sample analysis	3179
2	Irrigation water analysis	1811
3	Plant sample analysis	2478
	Total	7468

**4.4.1 Recommendation for Farmers
Nutrient Management**

Effect of NPK levels on growth, yield and nutrient uptake by isabgol

The farmers of Saurashtra region growing isabgol are recommended to apply 30 kg nitrogen, 30 kg phosphorus and 30 kg potash/ha along with FYM 5 t/ha at the time of sowing and remaining 30 kg N as top dressing at 45 DAS for getting higher seed yield and net realization.



Effect of N, P and K levels on growth, yield and nutrients uptake by bottle gourd

The farmers of South Saurashtra Agro-climatic Zone growing bottle gourd in summer season are recommended to apply 125-75-75 kg N-P₂O₅-K₂O/ha for achieving higher yield and net return. Nitrogen should be applied in three equal splits (Basal and remaining nitrogen at 30 and 45 days after sowing as spot application), full dose of phosphorus and potash as basal.



Effect of fresh cow dung on yield, quality and uptake of nutrients in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are recommended to apply slurry of 1500 kg/ha fresh (upto five days) cow dung (cow dung: water - 1:3) through drenching at the time of sowing or RDN (12.5 kg/ha) through FYM (about 2.5 t/ha) + 25:50 kg P₂O₅:K₂O per ha for getting higher yield and net return.



Effects of nutrient management and high density planting of Bt cotton under rainfed condition in Saurashtra region

The farmers of North Saurashtra Agro-climatic Zone growing *Bt* cotton under rainfed condition are recommended to sow *Bt* cotton at 60 cm x 45 cm spacing and apply 120 kg N, 10 t FYM and 500 kg castor cake/ha for obtaining higher yield and net return. The nitrogen should be applied in three splits *i.e.* 25 % as basal at the time of sowing, 50 % and 25 % as top dressing at 35-40 and 60-65 days after sowing, respectively by drilling in 10 cm soil depth.



Nutrient management in gram under conserve soil moisture condition

The farmers of *Bhal* region growing gram under conserved soil moisture condition are recommended to apply 20-40-00-20 kg N-P₂O₅-K₂O-S/ha for obtaining higher yield and net monetary returns.





Evaluation of microbial consortia enriched vermicompost in pearl millet

The farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet under organic condition are recommended to apply FYM 5 t/ha along with vermicompost 2 tonne/ha enriched with *Azospirillum* 2 L/ha, PSB 2 L/ha, KSB 2 L/ha, *Trichoderma harzianum* 3 kg/ha, *Pseudomonas fluorescens* 3 L/ha and *Beauveria bassiana* 3 kg/ha to obtain higher yield and net return and to improve soil health.



For enrichment of vermicompost, above each components should be mixed with 2 tonne vermicompost and sprinkled with little water (moisture content 20 %) and use in field after 10 days incubation period.

Response of summer sesame to levels of potassium and sulphur

The farmers of North Saurashtra Agro-climatic Zone growing sesame during summer season are recommended to apply 40 kg K_2O and 20 kg sulphur per hectare as a basal dose with recommended dose of nitrogen and phosphorus (50:25 N, P_2O_5 kg/ha) fertilizers for getting higher seed yield and net return.

Cultural Practices

Standardization of periodicity of sulphur, zinc and iron in prevalent *kharif* groundnut -based cropping system

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut - *rabi* wheat sequence cropping are recommended to apply Fe 10 kg/ha, Zn 5 kg/ha and S 20 kg/ha in form of ferrous sulphate, zinc sulphate and cosavet (Fertis), respectively once in two years as basal, in both groundnut and wheat, for obtaining higher groundnut equivalent yield and net return.



Management of reddening in *Bt* cotton

The farmers of South Saurashtra Agro-climatic Zone growing *Bt* cotton are recommended to spray multimicro nutrient Grade -IV @ 1 % (100 g/10 lit) at 100 DAS or apply 40 kg S/ha as basal dose along with RDF 240-50-150 $N-P_2O_5-K_2O$ kg/ha for reducing cotton reddening, achieving higher yield and net realization.



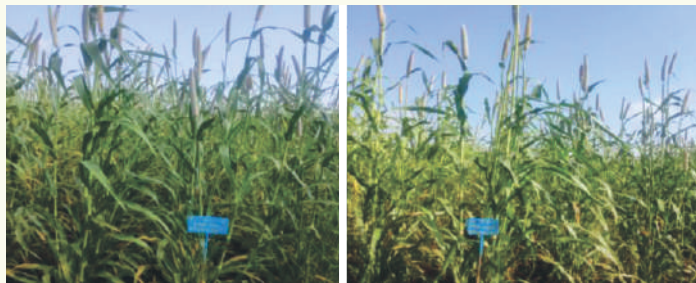
Agronomic biofortification of pearl millet cultivars through zinc fertilizer

The farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are recommended to apply 20 kg $ZnSO_4$ /ha in soil as basal, seed treatment of 3 g $ZnSO_4$ /kg seed and foliar spray of 0.5 % $ZnSO_4$ with 0.25 % lime at tillering and flowering stage in addition





to recommend dose of fertilizers (80-40-00 N-P₂O₅-K₂O kg/ha) to increase the Zn content of grain and fodder of pearl millet cultivar GHB-732 having low Zn content.



The farmers are also recommended to sow high zinc content (>40 ppm) pearl millet cultivar GHB 1225 and apply foliar spray of 0.5 % ZnSO₄ with 0.25 % lime at tillering and flowering stage in addition to recommended dose of fertilizers (80-40-00 N-P₂O₅-K₂O kg/ha) to obtain higher yield and net returns as well as to improve quality of grain and fodder.

Feasibility of seed spices intercropping with autumn-planted sugarcane (*Saccharum complex hybrid*)



The farmers of South Saurashtra Agro-climatic Zone growing autumn-planted sugarcane are recommended to grow one row of fenugreek as intercrop in sugarcane planted at 90 cm row spacing for securing higher yield & additional net return.

Improving phosphorus use efficiency in summer groundnut with microbial culture

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are recommended to apply 40 kg/ha of P₂O₅ + PSB (*Bacillus subtilis*-1 x 10⁸ cfu/g) culture @ 15 ml/kg seed in addition to recommended dose of nitrogen and potash (25-50 kg N-K₂O/ha) for securing higher yield and net income.

Irrigation Management

Response of drip irrigated castor to plant geometry and nitrogen fertigation

The farmers of South Saurashtra Agro-climatic Zone growing irrigated castor during *kharif* season are recommended to adopt plant geometry of 120 cm x 60 cm or 150 cm x 60 cm and irrigate the crop with drip irrigation and apply RDN 30 kg/ha (25 %) as a soil application (15 kg/ha as basal and 15 kg/ha at 30 DAS), remaining 90 kg/ha (75 %) RDN 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 and potash (50-50 kg P₂O₅ and K₂O/ha) as basal for obtaining higher castor seed yield and net return.



The drip system details as under: -

Details	Month	Operating time (Minutes)
Lateral spacing : 120 cm or 150 cm	October	110-125
Dripper spacing : 60 cm	November	100-110
Dripper discharge rate : 4 lph	Dec.-Jan.	95-105
Operating pressure : 1.2 kg/cm ²	-	-
Operating frequency: Every 3 rd day irrigation	-	-

Weed Management

Weed management in *kharif* maize

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* maize are recommended to adopt following practices for effective weed management and achieving higher grain yield and net realization without any phytotoxic effect on succeeding crops i.e., wheat, chickpea, coriander and mustard.



For effective management of purple nutsedge and other weeds

- Atrazine 500 g/ha (50 % WP 20 g/10 L water) as pre-emergence *fb* Tank-mix halosulfuron-methyl 30 g/ha (75 % WG 0.8 g/10 L water) + Topramezone 12.5 g/ha (33.6 % SC 0.744 g/10 L water) as post-emergence at 30 DAS or HW at 15 and 30 DAS

For effective management of purple nutsedge

- Atrazine 500 g/ha (50 % WP 20 g/10 L water) as pre-emergence *fb* halosulfuron-methyl 60 g/ha (75 % WG 1.6 g/10 L water) as post-emergence at 30 DAS or HW at 15 and 30 DAS.

For effective weed management

- Atrazine 500 g/ha (50 % WP 20 g/10 L water) as pre-emergence *fb* Topramezone 25 g/ha (33.6 % SC 1.488 g/10 L water) as post-emergence at 30 DAS or HW at 15 and 30 DAS.

Weed management in *Bt* cotton under dry farming condition (Vallabhipur)

The farmers of *Bhal* region growing *Bt* cotton under rainfed condition are recommended to apply pendimethalin (30 % EC) 0.900 kg/ha (3 lit./ha) as pre-emergence *fb* HW and IC at 30 and 60 DAS or HW and IC at 30, 60 and 90 DAS for effective weed management and achieving higher seed cotton yield and net realization.

4.4.2 Recommendation for Scientific Community Optimization of nutrient package in *Bt* cotton under irrigated condition



If soil status of available nitrogen and phosphorus is low and potassium is high, than apply 180:50:113 kg/ha N:P₂O₅:K₂O to *Bt* cotton. N fertilizer apply in five splits of 20 % each *viz*: as basal, at 30, 60, 90 and 120 DAS and K₂O in two splits *viz*; 50 % as basal and at 30 DAS and P₂O₅ as basal. In addition, apply *Azotobacter*, PSB and KSB each 3 lit./ha through drenching for getting higher yield.

Improving phosphorus use efficiency in summer groundnut with microbial culture

It is informed to scientific community that in summer groundnut apply 40 kg/ha of P₂O₅ + DGRC (microbial consortia) culture (10 g/kg seed) for obtaining higher groundnut pod and haulm yield.

Response of sugarcane (*Saccharum complex hybrid*) to N, P and K nano-fertilizers



The scientific community is informed that application of recommended dose of fertilizers *viz*. 250-125-125 kg N, P₂O₅ and K₂O/ha or the application of 1/5th of RDF Nano-fertilizer (50-25-25 kg N, P₂O₅ and K₂O/ha) + *Azotobacter* + PSB each @ 4 litre/ha gave higher cane yield in sugarcane.



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. Plant protection mainly includes two groups i.e. Entomology and Plant Pathology.

Production of *Sawaj* brand bio-agents and Microbial products

During the year 2022-23, Department of Plant Pathology has produced and distributed bio-agents under the trade name "*Gir Sawaj*" as shown in table below. Department also produced and distributed products like *Rhizobium*, *Azotobacter* and PSB liquid bio-fertilizer to farmers, State Departments, other Govt. bodies etc. at reasonable price.

Table 4.5.1 Production of 'Gir Sawaj' brand bio-agent and liquid bio-fertilizer

Sr. No	Name of Product	Quantity
1	<i>Trichoderma</i> (q)	23.12
2	<i>Rhizobium</i> (liter)	639
3	<i>Azotobacter</i> (liter)	513
4	PSB (liter)	1534
5	<i>KMB</i> (liter)	630

Department of Entomology has produced various microbial agents under the trade name "*Gir Sawaj*" e.g. viruses, bacteria, fungi, protozoans and nematodes are being used in IPM program as shown in below table. Among viral pathogens, nuclear polyhedrosis viruses of *Helicoverpa* (*HNPV*), *Spodoptera* (*SNPV*), entomopathogenic fungi *Beauveria bassiana*, 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 4.5.2 Production of 'Gir Sawaj' brand microbial agents, traps, lure etc.

Sr. No.	Name of Product	Quantity
1	<i>Beauveria</i> (q)	60.99
2	<i>Metarhizium</i> (q)	11.02
3	<i>HaNPV</i> (litre)	109
4	<i>SNPV</i> (litre)	90.25
5	Trichocard (Nos.)	1424
6	Fruit fly traps (Nos.)	15569
7	Fruit fly lure for vegetable crops (Nos.)	2568
8	Fruit fly lure for fruit crops (Nos.)	17918
9	Pheromone Trap (Nos.)	16063
10	Pheromone Lure (Pink bollworm) (Nos.)	22154
11	Pheromone Lure (<i>Heliothis</i>) (Nos.)	10728
12	Pheromone Lure (Brinjal shoot and fruit borer) (Nos.)	414
13	Pheromone Lure (<i>Spodoptera</i>) (Nos.)	3786
14	Pheromone Lure (Fall armyworm) (Nos.)	90
15	MDP Technology for Pink bollworm (100 gm Tube)	176
16	MDP Technology for Brinjal shoot and fruit borer (100 gm Tube)	33
17	Honey (litre)	364
18	Chrysopa eggs (Nos.)	370000

4.5.1 Recommendation for Farmers

Entomology

Bio-efficacy of insecticides against leaf eating caterpillar, *Spodoptera litura* Fab. infesting soybean

The farmers of Gujarat growing soybean are recommended to spray spinetoram 11.70 SC, 0.011 % (9 ml/10 l of water) or emamectin benzoate 1.9 EC, 0.002 % (8.5 ml/10 l of water), first at the initiation of pest infestation and second spray at 15 days after first spray, for effective and economical management of leaf eating caterpillar.



As per CIB & RC Format

Year	Crop	Pest	Pesticides/ Bio-pesticides formulation	Dosage			Quantity of formulation in 10 l of water (g or ml)	Quantity of water/ Soil amendments required (kg or l/ha)	Application schedule	Waiting period/ PHI (days)
				a.i. (g/ha)	Quantity of formulation g or ml/kg seed, kg or l/ha	Con. (%)				
2022-23	Soybean	Leaf eating caterpillar, <i>S. litura</i>	Spinetoram 11.70 SC	53	0.450 l	0.011	9 ml	500 l	First spray at initiation of pest infestation, second spray at 15 days interval after first spray	30
			Emamectin benzoate 1.9 EC	8	0.425 l	0.002	8.5 ml			20

Management of mealybug, *Maconellicoccus hirsutus* Green infesting custard apple

The farmers of South Saurashtra Agro-climatic Zone having custard apple orchards are recommended to apply two sprays of fenobucarb 50 EC, 0.1 % (20 ml/10 l of water) or first spray of *Beauveria bassiana* 1.15 WP (Min. 1×10^8 cfu/g) 0.007 % (60 g/10 l of water) followed by second spray of fenobucarb 50 EC, 0.1 % (20 ml/10 l of water), first at initiation of pest infestation and second at 15 days after first spray for the effective management of mealybug.



Year	Crop	Pest	Pesticides/ Biopesticides formulation	Dosage			Quantity of formulation in 10 l of water (g or ml)	Quantity of water/Soil amendments required (kg or l/ha)	Application schedule	Waiting period/ PHI (days)
				a.i. (g/ha)	Quantity of formulation g or ml/kg seed, kg or l/ha	Con. (%)				
2023	Custard apple	Mealy bug	Fenobucarb 50 EC	--	1.4 l	0.10	20 ml	700 l	First spray at initiation of pest infestation and second spray at 15 days after first spray	09
			<i>Beauveria bassiana</i> 1.15 WP	--	4.2 kg	0.007	60 g			--



Effect of solarization on infestation of pulse beetle and quality of chickpea seeds

The farmers of Gujarat are recommended that solarization of chickpea seeds in transparent polythene (700 gauge) packet (5 cm thick seed layer) for 6 days (4 hrs on each day between 11.00 to 15.00 hours) during summer sunny days can protect from pulse beetle damage and maintain seed germination (Above 85.00 % IMSCS level) up to 9 months of storage.

Plant Pathology

Efficacy of ready-mix formulation of fungicides against foliar diseases of cumin

The farmers of Saurashtra region growing cumin are recommended to spray metiram 55 +

pyraclostrobin 5 WG, 0.180 % (30 g/10 l of water) or pyraclostrobin 13.3 + epoxiconazole 5 SE, 0.027 % (15 ml/10 l of water) for blight and metiram 55 + pyraclostrobin 5 WG, 0.180 % (30 g/10 l of water) for powdery mildew disease, first at 30 days after sowing and subsequent two sprays at an interval of 20 days for effective and economical management.



As per CIB & RC Format

Year	Crop	Pest	Pesticides/ Biopesticides formulation	Dosage			Quantity of water/ Soil amend- ments required (kg or l/ha)	Applicati on schedule	Waiting period/ PHI (days)	Remarks	
				a.i. (g/ha)	Quantity of formulation g or ml/kg seed, kg or l/ha	Con. (%)					Quantity of formulatio n in 10 l of water (g or ml)
2023	Cumin	Blight & Powdery mildew diseases	Metiram 55 + Pyraclostrobin 5 WG	900	1.5 kg	0.180	30 g	500 l	First spray at 30 DAS and subseque nt two sprays at an interval of 20 days	20	This fungicide is registered in CIB- RC for blight and Powdery mildew diseases in cumin crop
			Pyraclostrobin 13.3 + Epoxiconazole 5 SE	137. 25	0.750 l	0.027	15 ml			500 l	22

Chemical control of die-back of mango

The farmers of South Saurashtra Agro-climatic Zone cultivating mango are recommended to apply three sprays of tebuconazole 50 + trifloxystrobin 25

WG, 0.094 % (12.50 g/10 l of water) after pruning, first spray just before onset of monsoon and subsequent two sprays at 30 days interval after first spray for effective and economical management of die-back disease.

As per CIB & RC Format

Year	Crop	Pest	Pesticides/ Biopesticides formulation	Dosage			Quantity of water/Soil amendments required (kg or l/ha)	Application schedule	Waiting period/ PHI (days)	Rema- rk (s)	
				a.i. (g/ha)	Quantity of formulation g or ml/kg seed, kg or l/ha	Con. (%)					Quantity of formulation in 10 l of water (g or ml)
2023	Mango	Die back	Tebuconazole 50 + Trifloxystro- bin 25 WG	940	1.25 kg	0.094	12.50 g	1000 l	First spray at before onset of monsoon and subsequent two sprays at an interval of 30 days	15	Fungic ide is labelle d for mango crop

4.5.2 Recommendation for Scientific Community

Entomology

Effect of detopping on defoliators and stem rot in *kharif* groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut in *Kharif* season are recommended to detop the crop 5 cm in length from the top at 30 days after sowing for effective and economical management of defoliators *viz*; *Helicoverpa* & *Spodoptera*.

Plant Pathology

Efficacy of ready-mix formulation of fungicides against foliar diseases of cumin

Three spray of azoxystrobin 11 + tebuconazole 18.3 SC, 0.044 (15 ml/10 l of water), first at 30 days after sowing and subsequent two sprays at an interval of 20 days found effective for the management of blight and powdery mildew diseases of cumin.

Efficacy of different fungicides against powdery mildew diseases of fenugreek

Three spray of difenoconazole 25 EC, 0.013 % (5 ml/10 l of water) or tebuconazole 50 + trifloxystrobin 25 WG, 0.038 % (5 g/10 l of water) or tebuconazole 10 + sulphur 65 WDG, 0.150 % (20 g/10 l of water), first spray at 30 days after sowing and subsequent two sprays at 20 days interval after first spray found effective for management of powdery mildew of fenugreek. Treat the seeds with thiram @ 3 g/kg seed at the time of sowing.



Utilization of different wastes on the yield of oyster mushroom (*Pleurotus sajor caju*)

Sugarcane bagasse can be used as substrate with 5 per cent spawn rate for the higher sporophore production (biological efficiency) with better nutritional and biochemical properties of oyster mushroom (*Pleurotus sajor caju*).



Chemical control of die-back of mango

Three spray of azoxystrobin 18.2 + difenoconazole 11.4 SC, 0.037 % (12.50 ml/10 l of water) or azoxystrobin 18.2 + difenoconazole 11.4 SC, 0.030 % (10 ml/10 l of water), first spray just before





onset of monsoon and subsequent two sprays at 30 days interval after first spray found effective for management of die-back of mango.



Effect of different drying techniques with use of various media for drying of flower *Butea monosperma*



4.6 Horticulture and Forestry

Horticulture and Agro Forestry carry out the research on fruits science, vegetables science, post-harvest technology of fruits & vegetables, floriculture & Landscape Architecture and research on spices. This also includes the development of new fruit and vegetable crop varieties.

Planting material of fruit crops, seedling and Ornamentals & Medicinal plants are provided to the farmers and stake holders at dispatching centre of Junagadh, Mangrol and Mahuva as per below table.

Table 4.6.1 Production of planting material of horticultural and other crops

No.	Planting Material	Production (Nos.)
1	Fruit crop graft	19216
2	Fruit crops saplings	111475
3	Seedlings	7539
4	Ornamentals & Medicinal plants	49226

4.6.1 Recommendation for Farmers

Effect of time and intensity of pruning on yield of Jasmine (Mogra) *Jasminum sambac* (L) cv. Double type

Farmers of Saurashtra region growing jasmine (Mogra) are recommended to prune the crop up to 30 cm above ground level (Medium pruning) during 4th week of October for getting higher yield and net return.



4.6.2 Recommendation for processors

The dry flower processors are recommended to keep the flower of flame of the forest at open condition for sun drying for two days with embedded in borex powder as a media for obtaining good quality dried flower.

Effect of integrated nutrient management on growth, yield and quality in rejuvenated guava (*Psidium guajava*) cv. Bhavnagar Red.

Farmers of Saurashtra region having rejuvenated orchard of guava are recommended to apply 187.5g of each N:P₂O₅:K₂O/plant along with well decomposed FYM 5 kg/plant + Vermicompost 2.5 kg/plant + Azospirillum 125 ml/plant + PSB 15 ml/plant as basal dose during kharif season 187.50 g N/plant as split after completion of kharif season for getting higher yield and net return.



Nutrient management in cucumber under polyhouse

The farmers of Gujarat growing parthenocarpic cucumber under greenhouse are recommended to apply fertilizer 8.0-5.0-5.0 kg NPK/1000 m² as a basal + panchgavaya 3 % with three sprays at 30, 40 and 50 days after sowing to obtain higher yield and net return.



4.6.3 Recommendation for Scientific Community
Effect of time of irrigation and level of pruning on yield and quality of off seasonal custard apple (*Annona squamosa L.*) cv. GJCA-1

It is inform to scientific community that the custard apple should not be irrigated after completion of rest in the month of March resulted to dropping of flowering and fruit setting due to higher temperature with lower humidity.

4.7 Agricultural Engineering

The Agricultural Engineering group accomplished the studies on design, development & fabrication of

agricultural machinery, equipment, tools, sources of renewable energy, processing of agricultural goods and conservation of water etc.

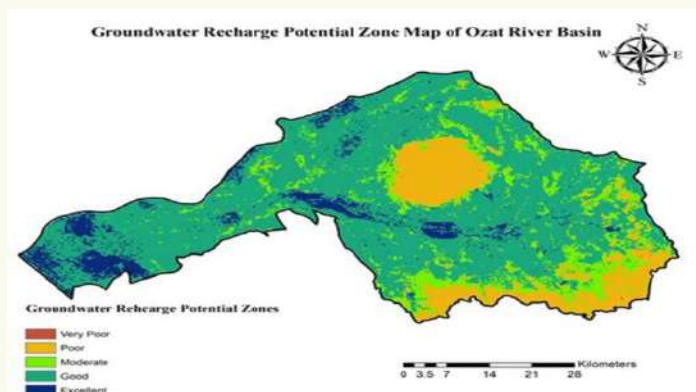
The “Testing and Training Center of Farm Machinery” under the Department of Farm Machinery and Power, CAET, JAU, Junagadh was established in August, 2008 by the State Govt. with the financial support from the Central Govt. under Rashtriya Krishi Vikas Yojna (RKVY). It is on the line of testing of agricultural 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 4.7.1 No. of Farm Machineries/ Implements/ equipments (category wise) tested at testing centre of FMPE, CAET

Category	Name of Equipment / Machine	Nos.
A	Land development, tillage & seedbed preparation equipment	44
B	Sowing and planting equipment	34
C	Intercultivation equipment	02
D	Plant protection equipment	20
E	Harvesting and threshing equipment	33
F	Equipment for residue management	13
G	Post-harvest and agro processing equipment	03
H	Hand tools	13
Total		162

4.7.1 Recommendation for Farmers
Identification of potential groundwater recharge zones in ozat river basin

It is recommended to the Farmers, NGOs and Government line departments that the Ozat river basin is divided in to five groundwater potential recharge zones namely excellent, good, moderate, poor and very poor having an area of 220.14 km² (6.93 %), 2094.81 km² (65.95 %), 430.05 km² (13.54 %), 430.87 km² (13.57 %) and 0.36 km² (0.01 %) respectively.





Cotton crop response to drip fertigation

The farmers of South Saurashtra Agro-climatic zone growing Bt. cotton crop are recommended to apply 25 % of RDF (240 N:50 P₂O₅:150 K₂O kg/ha) as basal doze and remaining NPK through drip fertigation in 12 equal splits after 30-45 days of sowing at 9 days interval using following drip irrigation system to get higher yield, net return, and water productivity as compared to conventional fertilizer applications adopted by farmers.



Specifications of drip irrigation system and its operating time

Drip irrigation system details			Drip irrigation system operating time at every 3 days		
SN	System components	Specification	SN	Month	Operating time (min.)
1	Lateral size	16 mm (OD)	1	September	60
2	Dripper rate	4 lph	2	October	90 to 125
3	Lateral type	Inline Drip	3	November	90 to 120
4	Dripper spacing	0.5 m	4	December	70 to 90
5	Lateral spacing	1.2 m	5	January	70 to 90
6	Nos. of rows /drip line	1 no.			

Influence of crop cultivation method and slope on runoff and soil loss under natural rainfall condition

The farmers of south Saurashtra Agro-climatic zone growing cotton and groundnut are recommended to keep the land slope upto 0.75 % to conserve more water into the medium black soil. In order to reduce the soil loss, they are recommended to cultivate groundnut crop along land slope upto 0.5% and across the land slope upto 0.75 %.



Response of fertigation under different irrigation systems on sweet corn

Farmers of Saurashtra region growing sweet corn during rabi season are recommended to apply 100 % phosphorous of 75% RDF (90:45:45 N:P₂O₅:K₂O) and 25 % N and K of 75 % RDF as a basal dose and rest N and K through sub surface drip irrigation (installed at 30cm depth) in 10 equal splits after 25 days of sowing at 6 days interval to obtain higher yield, fertilizer use efficiency, water use efficiency and net return.



Details of drip system	Irrigation scheduling
Lateral spacing : 1.2 m Drripper spacing: 0.40 m Drripper discharge: 4 lph Operating pressure: 1.2 kg/cm ²	At 0.8 ETc with 3 days interval a) November : 40 min b) December : 1hr 5 min c) January : 1 hr 20 min d) February : 2 hr 10 min

Techno-economic performance of solar pump

Farmers of south Saurashtra Agro-climatic zone are recommended to use the solar photovoltaic pump for getting higher water horse power, discharge, array efficiency and overall efficiency during 10 am to 4 pm as the period is feasible to apply irrigation in field. The total cost of solar photovoltaic pump is lower as compared to electric motor pump and diesel engine pump and it is ecofriendly.



Hydraulic study of rain pipe irrigation system under solar photovoltaic pump

Farmers of south Saurashtra agroclimatic zone are recommended to use solar photovoltaic pump operated rain pipe irrigation system to irrigate the field during 10 am to 4 pm.



Particular	Details
Solar photovoltaic pump	5 hp AC
Solar Panel output	4800 W
Rain pipe	Diameter: 32 mm, Wall thickness: 300 micron
Operating pressure	0.5 kg/cm ²
Length of rain pipe	30m
Spacing between two rain pipe	5m

Adaption to climate change: Effect of hydrogel and organic manures to mitigate biotic stress in Bt. cotton

The farmers of north Saurashtra agro-climatic zone growing Bt. Cotton (G. cot Hybrid-8 BG-II) under dry farming conditions are recommend to apply hydrogel @ 2.5 kg/ha before sowing (1:10 mixture of Pusa hydrogel and sand through drilling in the furrow) or FYM @ 10 t/ha to minimize moisture stress during dry spells and obtaining maximum rain water use efficiency, higher productivity and net returns.



Development of biodegradable packaging film based on whey protein isolate

The entrepreneurs and industrialists are recommended to adopt a process technology developed by Junagadh Agricultural University for the preparation of biodegradable plastic film based on whey protein isolate by using 1.4:1 WPI to glycerol ratio, 6.6 pH and 93 % ultra-sonication power by casting method to replace synthetic plastic to use as carry bag and dry matter packaging film.



Modification of gel expulsion machine for aloe vera leaves

The farmers and entrepreneurs are recommended to use aloe vera gel expulsion machine developed by Junagadh Agricultural University to get maximum gel recovery (39 %), gel expulsion efficiency (79 %) and output capacity (98 kg/h) with better quality of



gel to operate at 75 rpm expulsion roller speed for aloe vera leaves having thickness more than 20 mm to reduce 79 % cost of expulsion.



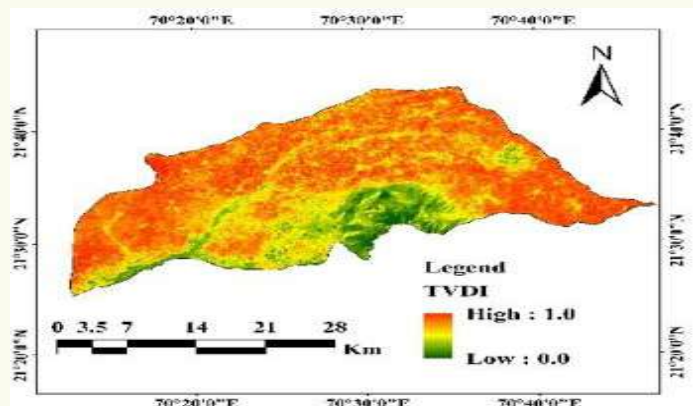
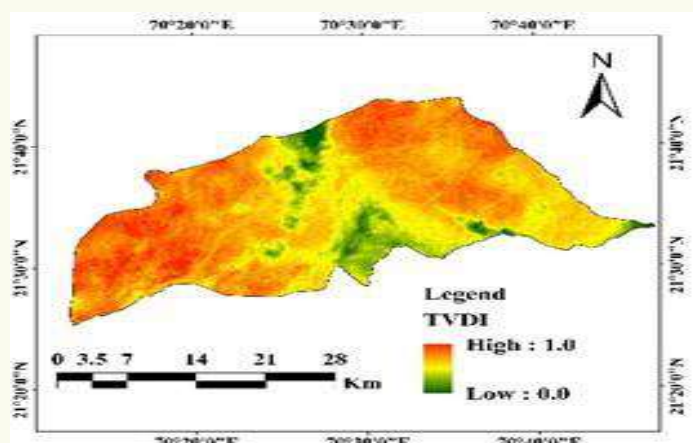
Development and evaluation of defatted sesame flour incorporated protein enriched extruded products

The extrudate manufacturing units and farmers are recommended to adopt the process technology developed by Junagadh Agricultural University for making corn based protein enrich extrudates products using defatted sesame flour. The extrudates should be produce by taking a proportion of defatted sesame flour and corn flour as 23:77 to increase the protein content of extrudates by using twin screw extruder machine. The suggested optimum condition to prepare extrudates using defatted sesame flour is feed moisture content : 15.60 % (wb), die head temperature : 130°C, feed temperature : 60°C, barrel temperature : 100°C and screw speed: 250 rpm. The developed method givegood quality extrudates with 19.21 % high protein content.



**4.7.2 Recommendation for Scientific Community
Soil moisture based irrigation water management in canal command using remote sensing technology**

The Planners, NGOs and Government Departments of South Saurashtra Agro Climatic region are recommended to use the following relationship of surface soil moisture with remote sensing images based Temperature Vegetation Dryness Index (TVDI) to find out the spatial surface soil moisture for the estimation of crop water requirement for the agricultural fields. $Surface\ Soil\ Moisture\ (\%) = -45.457\ TVDI + 43.71$ Where, TVDI = Temperature Vegetation Dryness Index



Influence of crop cultivation method and slope on runoff and soil loss under natural rainfall condition

On availability of daily rainfall data, the following empirical rainfall-runoff models are recommended for the hydrologic design of water arvesting/conservation structures to estimate the runoff from the field of otton and groundnut crop cultivation either along or across the land slope up to 1 % for medium black soil.

Crop	Cultivation practices	Rainfall-runoff model	R ²
Cotton	Along	RO = 0.6307(RF) - 7.7509	0.901
Cotton	Across	RO = 0.5908(RF) - 7.3239	0.898
Groundnut	Along	RO = 0.5752(RF) - 7.1512	0.895
Groundnut	Across	RO = 0.5195(RF) - 6.4703	0.888

Where, RO is daily runoff (mm) and RF is the daily rainfall (mm)

On the availability of daily rainfall and land slope data, following empirical models are recommended to estimate the runoff from the fields of

cotton and groundnut crop cultivation either along or across the land slope up to 1 % for medium black soil.

Cultivation practices	Model	R ²
Cotton Along	RO = 0.2546 (RF) ^{1.1787} (S) ^{0.2450}	0.885
Cotton Across	RO = 0.2404 (RF) ^{1.1787} (S) ^{0.2759}	0.882
Groundnut Along	RO = 0.2535 (RF) ^{1.1774} (S) ^{0.3900}	0.878
Groundnut Across	RO = 0.2167 (RF) ^{1.1720} (S) ^{0.2571}	0.866

Where, RO is the predicted daily runoff (mm), RF is the daily rainfall (mm) and S is the slope of the bed (%).

Influence of crop cultivation method and slope on runoff and soil loss under natural rainfall condition

On the availability of annual rainfall and land slope data, the following empirical models are

recommended to estimate the annual soil loss from the fields of cotton and groundnut crop cultivation either along or across the land slope up to 1 % for medium black soil.

Cultivation practices	Model	R ²
Cotton Along	AS _L = 1.1669(ARF) ^{0.2281} (S) ^{0.2269}	0.904
Cotton Across	AS _L = 2.0660(ARF) ^{0.1356} (S) ^{0.2397}	0.961
Groundnut Along	AS _L = 1.1016(ARF) ^{0.2277} (S) ^{0.3603}	0.951
Groundnut Across	AS _L = 0.6235(ARF) ^{0.2910} (S) ^{0.2532}	0.956

Where, AS_L is the annual soil loss (ton/ha/year), S is the slope of the bed (%) and ARF is the annual rainfall (mm).

Identification of potential groundwater recharge zones in ozat river basin

The scientific communities are informed that the planning for recharging of 610.18 MCM runoff (75 % dependibility) of Ozat basin may be done by recharging through 4520 check dams, 51113 farm ponds, 22599 open wells, 5650 tube wells in excellent and good groundwater recharge potential zones, while 10496 Gabion/loose rock dams in moderate groundwater potential zones.

4.8 Basic Science

Basic Science group works on the areas of plant Biochemistry & Biotechnology, Plant Physiology and Plant molecular Biology. It includes research on Genetic manipulation of crops for stress resistance,

molecular biology and genetic engineering work in plant sciences.

**4.8.1 Recommendation for Farmers
Preparing for climate change - Growth and development of arboreum cotton in response to growth regulators**

The farmers of South Saurashtra Agro-climatic Zone growing arboreum cotton under irrigated condition are recommended to timely sow the crop with foliar spray of Salicylic Acid @ 70.00 ppm (0.70 g/10 lit. water) at 45 and 60 DAS for balance growth to obtain higher seed cotton yield and net return.





**4.8.2 Recommendation for Scientific Community
Development of biochemical and molecular markers for heat tolerance in chickpea**

The chickpea genotype namely ICC-4958 was identified highly tolerant when exposed to 42/37 °C temperature at germination stage. This genotype had high antioxidant activity, ascorbic acid, glutathione,

super oxide dismutase, ascorbate peroxidase, glutathione reductase along with Quinone oxidoreductase, glutaredoxine and heat shock protein 70. SSR markers namely Cam1536, TA27, TR 58 could also reveal this genotype different at DNA level. Hence, this genotype can be exploited in breeding to develop heat tolerant lines/varieties of chickpea.

Biochemical analysis based lipid indices of edible, non-edible and medicinal herbs oils

Scientific community involved in lipid indices of edible oil research is recommended to use the sets of following biochemical based fatty acids calculation for the quality of oils and their lipid indices.

Edible oils	DR	ODR	LDR	MUFA	PUFA	SFA	DU	UI	AI	TI
GG -20	0.009	0.247	0.001	63.72	20.64	15.64	105.0	590.5	0.14	10.32
GG-21	0.008	0.185	0.003	69.62	15.67	14.71	101.0	597.0	0.13	9.18
GG-3	0.009	0.451	0.001	44.47	35.93	19.6	116.3	562.8	0.19	13.30
Coconut seed oil	0.007	0.396	0.011	11.43	7.05	81.52	25.5	129.4	20.73	34.60
Corn oil	0.012	0.563	0.005	33.24	41.43	25.33	116.1	522.7	0.67	23.17
Cotton seed oil	0.003	0.645	0.035	26.01	40.88	33.11	107.8	468.2	2.19	28.78
Soybean	0.022	0.612	0.025	23.5	53.88	22.62	131.3	541.7	0.36	14.30
Sunflower	0.007	0.630	0.019	30.71	47.09	22.2	124.9	544.6	4.32	17.60
Brown mustard seed	0.181	0.647	0.439	57.51	30.26	12.23	118.0	614.4	0.06	40.74
White sesame	0.001	0.558	0.011	39.17	48.19	12.64	135.6	611.5	0.09	10.00
Black sesame	0.001	0.574	0.007	38.07	50.47	11.46	139.0	619.8	0.08	8.34

DR= Desaturation ratio; ODR= Oleic desaturation ratio; LDR= Linoleic desaturation ratio; MUFA= Monounsaturated fatty acid; PUFA= Polyunsaturated fatty acid; SFA = Saturated fatty acid; DU= Degree of unsaturation; UI= Index of unsaturation; AI= Atherogenic index; TI= Thrombogenic index

Biochemical analysis based lipid indices of edible, non-edible and medicinal herbs oils

Scientific community involved in the essential oil research of the following crops is recommended to use marker bioactive compounds detected through GC MS platform.

Name of crops	Important Marker Bioactive compounds
Black pepper (<i>Piper nigrum</i> L.)	Piperine (α -Phellandrene, 4.64 %) cis-sabinene (23.21 %) Caryophyllene (13.58 %) Caryophyllene oxide (0.33 %) 1, 4-Cyclohexadiene, 1-methyl-4-(1-methylethyl) (20.84 %)
Volatile oil of Cardamom	α -Terpinyl acetate (37.05 %) Eucalyptol (25.79 %) Sabinen (3.41 %)
Volatile oil of Cinnamom	Cinnamaldehyde, (E) (77.55 %) Copaene (2.98 %)

Name of crops	Important Marker Bioactive compounds
Volatile oil from leaves of cinnamom	Phenol, 2-methoxy-3-(2-propenyl) (79.17 %), Spathulenol (3.26 %) gamma.-Elemene (3.66 %), Caryophyllene (1.24 %)
Volatile oil of cloves	Caryophyllene (37.5 %) and Phenol, 2-methoxy-3-(2-propenyl)-(44.04 %)
Volatile oil of coriander leaves	LINALOOL (63.23 %), 2, 6-Octadien-1-ol, 3, 7-dimethyl-, acetate (7.78 %), 1, 6-Octadien-3-ol, 3,7-dimethyl (2.64 %), (1R)-2, 6, 6-Trimethylbicyclo [3.1.1]hept-2-ene (2.59 %)
Volatile oil of cumin seeds	Beta.-Pinene (19.09 %) Benzene, 1-methyl-4-(1-methylethyl) (12.4 %) 1, 4-Cyclohexadiene, 1-methyl-4-(1-methylethyl) (10.69 %) Benzaldehyde, 4-(1-methylethyl) (26.8 %) TERPIN-7-AL <GAMMA-> DB5-1106 (12.36%)
Volatile oil of curry leaves	Bicyclo [7.2.0] undec-4-ene, 4, 11, 11-trimethyl-8-methylene-, [1R-(1R@, 4Z, 9S@)] (29.28 %) Caryophyllene (4.44 %), alpha.-Caryophyllene (4.88 %) Azulene, 1, 2, 3, 3a, 4, 5, 6, 7-octahydro-1, 4-dimethyl-7-(1-methylethenyl) - (21.24 %) [1R-.alpha., 3a.beta., 4.alpha.,7.beta.)]-Caryophyllene oxide (4.05 %).
Volatile oil of Dill seed	Tetrahydro carvone (19.82 %) trans-dihydrocarvone (14.53 %) cis-Carvyl acetate (25.7%) Eugenol (0.01 %) And Apiol (Abotion drug) (17.59 %)
Volatile oil of Dry ginger	CURCUMENE (16.56 %) Zingiberene (21.03 %); FARNESENE <(E, E)-ALPHA (15.26 %) beta-Sesquiphellandrene (7.61 %) VALERIANOL (5.91 %)
Volatile oil of fennel seed	Fenchone (8.93 %) Anisole, p-allyl (5.29 %) (Estragole) cis-Anethol (68.56 %)
Volatile of Garlic oil	1, 3-Dithiane (6.7 %) Dimethyl trisulfide (7.43 %) Diallyl disulphide (17.72 %) Hydroperoxide, 1, 4-dioxan-2-yl (26.34 %) Trisulfide, di-2-propenyl (31.49 %)
Volatile oil of holy basil	1, 6-Octadien-3-ol, 3,7-dimethyl (18.47 %)/(Linalool) METHYL CINNIMATE (8.48 %) and METHYL CINNIMATE <(E)- (45.94 %)
Volatile oil of mint leaves	Limonene (5 %) 2-Cyclohexen-1-ol, 2-methyl-5-(1-methylethenyl)-, trans-(35.63 %) 2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl) (31.59 %) trans-Carveyl acetate (5.19 %)
Volatile oil of nutmeg	1R)-2, 6, 6-Trimethylbicyclo [3.1.1] hept-2-ene/ (α -Pinene-14.64 %) Bicyclo [3.1.0] hexane, 4-methylene-1-(1-methylethyl)-(cis-sabinene-18.5 %) Cyclohexene, 1-methyl-4-(1-methylethenyl) -, (S) - (Limonene-5.84 %) 1, 4-Cyclohexadiene, 1-methyl-4-(1-methylethyl) - (α -Terpinene-5.13 %) 3-Cyclohexen-1-ol, 4-methyl-1-(1-methylethyl)-((R)-(-); (-)-Terpinen-4-ol-8.05 %) Benzene, 1, 2-(methylenedioxy)-4-propenyl-, (E)-(β -Isosafrole-5.4 %)
Volatile oil of nutmeg mace	α -Pinene-(15.97 %); cis-sabinene-(17.66 %); α -Terpinene-(6.23 %), L-4-terpineol-(9.11%)
Turmeric oil & Oleoresin	Caryophyllene (6.74 % and 0.29,%) ZINGIBERENE (18.86 % and 4.59 %) Benzene, 1-(1, 5-dimethyl-4-hexenyl)-4-methyl (9.49 % and 0.45 %) SESQUIPHELLANDRENE <BETA>(14.25 % and 1.17 %) Tumerone (23.26 % and 17.39 %) Ar-tumerone (25.15 % and 8.93 %)

Diversity analysis of marine diatoms through SEM-EDX from surface microalgae of Saurashtra coastal belt

The scientific community working on diatoms of coastal belt of Saurashtra is recommended to use diatoms diversity analysis done through Scanning electron microscopy as ready references. The diatom analysis of marine samples from three locations (Okha, Veraval and Aadri) identified fifty diatom species and most of them are pennate types. The *Cocconeis* spp, *Grammatophora* spp, *Fragilaria* sp, *Nitzschia* sp, *Navicula* sp., *Achnanthes* spp and *Licmophora* were found dominant diatoms on the surface of microalgae. Again, diatom abundance of *Cocconeis scutellum* was reported higher than 52 % of total diatom considering three locations. The energy dispersive X-ray spectroscopy (EDS) graph prepared for individual species of diatoms from SEM images observed that the frustules of the diatoms were other than Si. It has many elements at various sites attached to them. The catalogue of diatoms and alfa-diversity index revealed many diverse rich populations in coastal belt of Saurashtra.

4.9 Animal Science

Cattle Breeding Farm, Junagadh Agricultural

Table: 4.9.1 Distribution of Semen doses from CBF

SN	Particular	Gir Bulls	Jaffrabadi Bulls
1	Frozen semen doses available in stock from last year (Nos.)	231185	140004
2	Frozen Semen doses Produced (Nos.)	28265	13295
3	Frozen Semen doses used for AI in Field (Nos.)	2210	2790
4	Frozen Semen doses used for AI on Farm (Nos.)	305	497
5	Frozen Semen doses sold to AI Workers (Nos.)	4160	1040
6	Frozen semen doses in stock (Nos.)	252775	148972
7	Animals distributed to Grampanchayat, Gaushala, other Institute etc. (Nos.)	24	42

4.10 Social Science

Social Science group works on the areas of Agricultural Economics, Agricultural Extension Education, Agricultural Statistics, Agribusiness Management and Home Science.

Agricultural economists worked on different research projects *viz.* Farm cost studies of important crops in Gujarat state; India's balance of trade in

University is the largest and oldest farm and is the only organized research station where pure breed *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 the research station has 184 hectare of land out of which 106.5 hectare is cultivated, 42 hectare uncultivated/ Grassland-vidi is being utilized for grazing and 22 hectare under road and buildings. The subsidiary farm known as Narsimehta 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.

agriculture with SAARC nations: An econometric analysis; Price forecasting for selected crops; Performance and Determinants of Plant Varietal Protection (PVP) Legislation in Indian Agriculture with Special Reference to Gujarat; Growth, instability and decomposition analysis of major nutri-cereals production in Gujarat; Creating a permanent machinery for studying the cost of cultivation/ production of

principal crops grown in Gujarat state. Yield, production and price forecast of different crops viz. *groundnut, cotton, pigeon pea, castor, cumin, gram, etc.* were analyzed for suggestions to farmers.

Various research projects are running by Post Graduate Institute of Agribusiness Management Institute, JAU, Junagadh, which includes Effect of micro irrigation system on livelihood in Saurashtra region; Business opportunities of exotic vegetables in Saurashtra; Value chain analysis of Kesar mango in Saurashtra region; Financial Literacy among the students of Junagadh Agricultural University; Export cost estimation and mileage of major commodities of Saurashtra.

Crop	Season	Priority districts
Bajra	<i>Kharif</i>	Banaskantha, Bhavnagar, Anand, Kheda and Panchmahals
	Summer	Banaskantha, Patan, Junagadh, Anand, Kheda and Vadodara
Jowar	<i>Kharif</i>	Banaskantha, Surat, Narmada and Bharuch
	<i>Rabi</i>	Porbandar, Junagadh, Bharuch, Narmada and Vadodara

Forecasting area, production and productivity of cotton and groundnut in Gujarat

It is advised to scientific community that the area, production and productivity of cotton and groundnut can be precisely predicted using the hybrid model in comparison to ARIMA and TDNN for Gujarat state.

Assessment of knowledge of agro-input dealers gained through certificate course on insecticide management

It is suggested to the extension personnel to organize regular training programs/courses for agro-input dealers for effective transfer of agricultural technology at the grassroots level.

Financial literacy among the students of Junagadh Agricultural University

It is advised to the competent authority that for enhancing financial literacy of Junagadh Agricultural University students, training should be imparted on financial attitude, financial behavior and especially financial knowledge as low level is more prevalent in this area of financial literacy.

Business opportunities of exotic vegetables in Saurashtra

The entrepreneur of Saurashtra region is advised to grab the business opportunities for exotic vegetables

4.10.1 Recommendation for Scientific Community Growth, instability and decomposition analysis of major nutri-cereals production in Gujarat

It is recommended to the policy makers that the satisfactory yield growth rate of bajra and jowar about 2 to 4 per cent during last two decades in Gujarat even after less reduction in area and production as well as it's low to medium instabilities in major nutri-cereals growing districts. To enhance area and production of bajra and jowar in Gujarat, sustained focus needs to be given on the following districts as given below in particular season.

by supplying timely and regularly and highly demanded exotic vegetable like red and green bell pepper/capsicum, baby corn and broccoli in three-star hotels/restaurants.

Knowledge of rural women regarding fruit processing and preservation in Amreli district

It is suggested to the extension functionaries to organize vocational/skill training programme for young, educated, having mass media exposure and innovative rural women on improved practices of processing and preservation of fruit crops. For effective and more participation of rural women training should be organised at village level in leisure time. It is important that women group should be linked with FPO for better marketing and branding of products.

Usefulness of Agro-met advisory service to the farmers of Jamnagar district

Scientific community advised that the Agro-met advisory service in local language is useful to take precaution measures which reduce crop losses. For improving the advisory, include information on different farming systems along with market intelligence & price forecast and long-range forecast advisory at village level given for pre-seasonal crop planning.



Attitude of farmers towards Agro-met advisory service

It is suggested to agro-met advisory providers to include information on post-harvest operations, market-related information, sources of seed material, and disseminate advisory services in audio-visual form.

Training need to farmers regarding rainwater harvesting and groundwater recharge

It is advised to extension personnel to organize one day training program on rooftop water harvesting for farm irrigation and borewell recharge through

demonstration and field visit along with information of various government schemes for higher adoption.

4.11 Transfer of Technology

Front Line Demonstration (FLD) conducted on farmers' field

Crop scientists of JAU have successfully conducted Front Line Demonstrations (FLDs) of newly developed varieties and production technologies on farmers' fields for speedy propagation among the farmers.

Table 4.11.1 Summary of FLDs 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 32, Girnar-4	12	4.80	21.94	19.60	11.69
2	Castor	GCH 9	29	11.60	35.55	30.49	16.53
3	Pearl millet (Summer)	GHB 1129	20	8.0	39.56	36.42	8.63
4		GHB 732	20	8.0	37.51	35.35	6.11
5		GHB 538	10	4.0	35.55	34.58	2.81
6	Pearl millet (Kharif)	GHB 1129	12	4.8	30.92	27.66	11.79
7		GHB 1225	13	5.2	31.78	28.68	10.81
8	Pigeon pea	GJP-1	9	9.0	16.59	14.07	16.00
9	Chickpea	GG 5 & GJG 6	20	20	25.75	21.94	17.00
10	Sesame (Summer)	GJT 5	3	2.40	8.15	7.41	9.99
11	Sesame (Kharif)	G.Til 4	4	3.20	7.01	6.39	9.70
12	Cotton	G. Cot. Hy.-24 BG II	65	60	25.97	25.70	0.50
13	Coriander	Gujarat Coriander-3	18	0.4	12.76	11.64	9.65
14	Fenugreek	Gujarat Fenugreek-2	3	0.4	19.35	17.25	12.17
15	Onion (Kharif)	Bhima Supar	6	0.4	328.91	295.92	11.15

Table 4.11.2 Summary of FLDs of Improved Technology

Sr. No.	Crop / other	Production technology	No. of FLDs	Total area under FLD (ha)	Yield in IP (q/ha)	Yield in FP (q/ha)	Increase in yield (%)
1	Groundnut (Summer)	Whole package (GJG 31)	18	7.20	22.54	20.03	12.58
2	Groundnut (<i>Kharif</i>)	Whole package (GJG 32/22)	32	12.80	23.60	20.15	14.81
3	Intercropping (Groundnut)	G'nut + Castor/ Pigeon pea	9	3.60	31.05	19.33	60.65
4	Intercropping (Sesame)	Cotton + Sesame	3	2.4	11.05	7.91	39.72
5	Intercropping (Castor)	Castor + G'nut	9	3.60	49.27	24.09	104.90
6	Sesame (Summer)	Whole package	5	4.0	7.12	5.98	19.08
		Improved variety	3	2.4	8.15	7.41	9.99
		Plant protection	2	1.6	7.54	7.17	5.16
7	Sesame (<i>Kharif</i>)	Whole package	4	3.2	8.65	6.87	25.80
		Fertilizer management	5	4.0	8.03	7.44	7.90
		Improved variety	4	3.2	7.01	6.39	9.70
		Plant protection	4	3.2	6.38	6.01	6.10
8	Cotton	Integrated Cotton Crop Management	49	25	26.03	24.73	4.90
		Intercropping	20	10	31.13	30.56	1.85

Note: 1. Improved technology includes crop production, plant protection and basic science.

2. Yield of inter cropping is the main crop (as shown in column-2) equivalent yield.

Table 4.11.3 Summary of FLDs of developed farm machineries/ implements

SN	Improved Technology	No. of FLD	Total Area (ha)
1	Cultivator cum spiked roller	2	0.5
2	Rotary Tiller cum Cultivator	3	0.34

Table 4.11.4 New research programs sanctioned

SN	Agency	No. of Research Programs	Amount (Rs. in Lakh)
1	ICAR	-	-
2	RKVY	1	125.00
3	Other Agencies	22	145.33
	Total	23	270.33