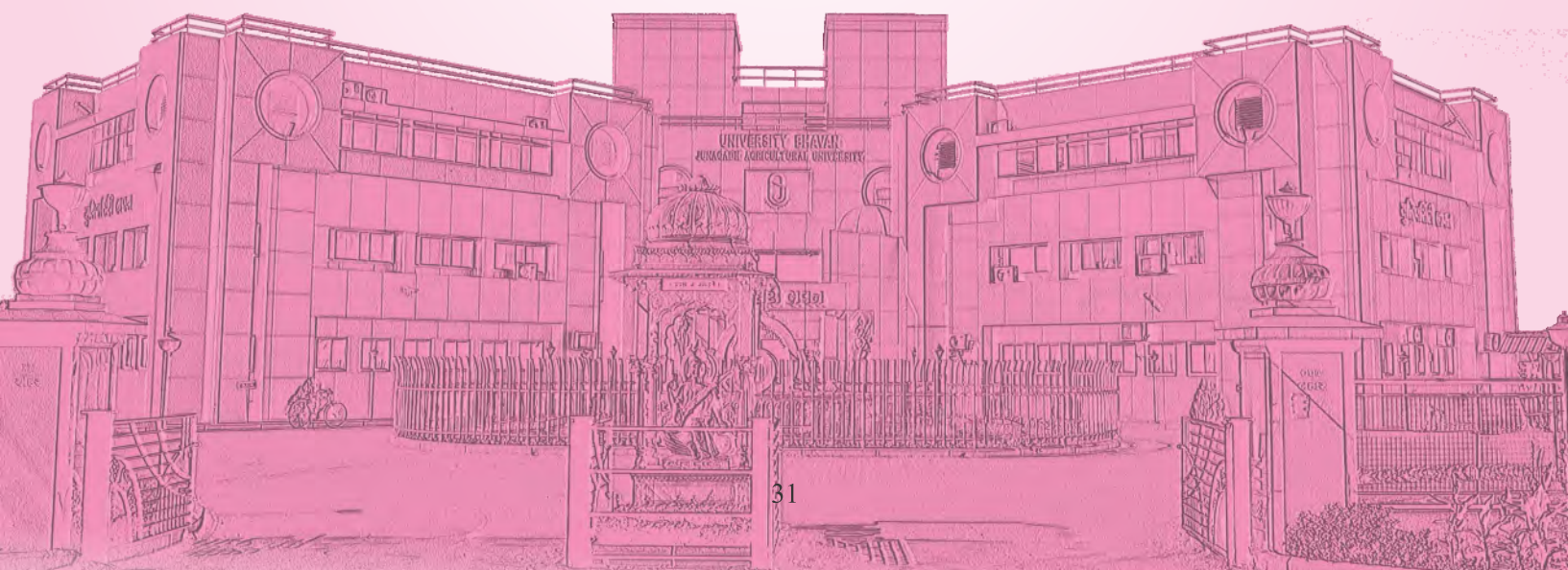




## Chapter - IV



# RESEARCH



#### 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. 17th Research Council meeting was organized on January 15, 2020 for approval of new research programs and research activities during the year.

**Table 4.1: Members of 17th Agricultural Research Council**

No.	Name	Designation
1	Dr. V. P. Chovatia	Vice-Chancellor (I/c) (Chairman)
2	Dr. V. P. Chovatia	Director of Research & Dean PG Studies (Member Secretary)
3	Dr. V. V. Rajani	Director of Extension Education
4	Shri B. M. Modi	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	Vacant	Associate Director of Research
8	Dr. P. Mohnot	Associate Director of Research
9	Dr. D. S. Hirapara	Associate Director of Research, JAU, Targhadia
10	Dr. V. P. Chovatia	Dean, Faculty of Agriculture & Horticulture
11	Dr. N. K. Gontia	Dean, Faculty of Agricultural Engineering & Technology
12	Dr. A.Y. Desai	Dean, Faculty of Fisheries Science
13	Dr. P. H. Tank	Dean Faculty of Veterinary Science & Animal Husbandry
14	Dr. K. A. Khunt	Dean, Faculty of Agribusiness Management
15	Dr. K. L. Dobaria	Convener, Crop Improvement AGRESCO Subcommittee
16	Dr. S. G. Savalia	Convener, Crop Production AGRESCO Subcommittee
17	Dr. L. F. Akabari	Convener, Plant Protection AGRESCO Subcommittee
18	Dr. D. K. Varu	Convener, Horticulture & Agro Forestry AGRESCO Subcommittee
19	Dr. P. M. Chauhan	Convener, Agricultural Engg. AGRESCO Subcommittee
20	Dr. U. D. Patel	Convener, Animal Science & Fisheries Science AGRESCO Subcommittee
21	Dr. B. A. Golakia	Convener, Basic Science AGRESCO Subcommittee
22	Dr. C. D. Lakhalani	Convener, Social Science AGRESCO Subcommittee
23	Dr. V. K. Poshiya	Rtd. Research Scientist
24	Dr. H. J. Vyas	Rtd. Research Scientist
25	Dr. B. A. Golakia	Professor & Head (Biochemistry)
26	Dr. K. L. Dobaria	Research Scientist (Groundnut)
27	Dr. B. K. Sagarka	Professor & Head (Agronomy)
28	Dr. P. M. Chauhan	Professor & Head (Renewable Energy Engg.)



29	Dr. M. R. Gadaria	Research Scientist (Bull Mother Farm, Amreli)
30	Dr. S. I. Yusufzai	Associate Professor, (College of Fisheries Science, Veraval)
31	Shri Sanjaybhai Ratibhai Vagadia	Progressive Farmer, At-Dhava (Gir) Ta-Talala Dist-Gir Somnath

## 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 scientists and the Director of Research in two meetings held during the month of December-2019 and February-2020 for evaluation of expenditure of planned schemes and reallocation of the funds, etc.

### State Programs

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

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

**Table 4.2.1: List of plan and non-plan research projects functioning in the university  
(A) Plan Scheme (Sponsored by 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 horti. res. & devp. activities	1997	Dept. of Horti., Junagadh
13	12096-00	Res. on micro irri. system in Saurashtra region	1997	Dept. of Agronomy, Junagadh
14	12131-00	Research on eco-friendly biological fertilizer	1997	Dept. of Pl. Patho., Junagadh
15	12712-06	Creation of additional posts as per Supreme court orders	1991	CBF, CoA, CAET, Junagadh & Coll. of Fish. Sci., Veraval
16	12712-5B	Campus development program (on campus)	2004	Directorate of Res., Junagadh
17	12903-00	Establishing of organic farming cell at Junagadh	2000	Dept. of Agronomy, Junagadh
18	12905-00	Proposal for research on watershed management	2000	MDFRS, Targhadia; GRS, Dhari & Dept. of SWCE, CAET, Junagadh
19	12907-00	Strengthening of agro-meteorology at JAU	2000	Dept. of Agronomy, Junagadh
20	12930-00	Establishment of new sub-center for research on cumin	1998	Agriculture School, Halvad
21	12931-00	Establishment of new research centre on onion crop	2003	Vegetable Research Station, Junagadh & FRS, Mahuva
22	12573-00	Research on tillage technology	2006	Dept. of Agronomy, Junagadh
23	12574-00	Research on rejuvenation of degraded coastal agro-eco systems of Saurashtra	2006	Research Training & Testing Centre, Junagadh
24	12575-00	Strengthening research in sesamum	2006	Agril. Res. Station, Amreli
25	12101-00	Centre of excellence on soil and water management	2006	RTTC, Junagadh; MDFRS, Targhadia; ARS (FC), Mahuva & FRS, Mangrol
26	12576-00	Research on post-harvest technology of important crops of Saurashtra	2006	Dept. of Processing & Food Engg., CAET, Junagadh
27	12582-00	Strengthening of research on genetically modified cotton	2009	Cotton Research Station, Junagadh
28	12583-00	Strengthening of wheat research	2009	Wheat Res. Station, Junagadh
29	12584-00	Strengthening research on castor	2009	Main Oilseed Research Station, Junagadh
30	12585-00	Strengthening research in sugarcane	2009	Sugarcane Res. Stat., Kodinar





31	12586-00	Strengthening of research in plantation and fruit crops at A.R.S. (Fruit crops)	2009	Agricultural Research Station (FC), Mahuva
32	12587-00	Conservation of plant biodiversity	2009	Dept. of Genetics & Plant Breeding, Junagadh
33	12588-00	Development of arid and semi-arid fruit crops	2009	Dept. of Horti., Junagadh
34	12590-00	Establishment of Bt cotton research centre at Surendranagar district	2011	Cotton Research Station, Kukada
35	12014-00	Establishment of spices res. centre at Junagadh	2011	Vegetable Res. Stat., Junagadh
36	12015-00	Establishment of bio-fertilizer unit at Junagadh	2011	Dept. of Plant Pathology, Junagadh
37	12018-00	Establishment of research centre on onion at Talaja Dist.: Bhavnagar	2011	Agriculture Research Station, Talaja
38	12019-00	Strengthening of dry farming research at Jam Khambhaliya	2012	Dry Farming Research Station, Jam Khambhaliya
39	12020-00	Strengthening of dry farming research at Vallbhipur	2012	DFRS, Jam Khambhaliya and Vallbhipur
40	12021-00	Establishment of mango res. project at Talala	2012	Dept. of Horti., Junagadh
41	12022-00	Project on mega seed for quality seed production & distribution	2012	Dept. of Seed Science & Tech., Junagadh
42	12023-00	Micronutrients and sulphur research in soils and plants in Saurashtra region	2012	Dept. of Ag. Chemistry & Soil Science Junagadh
43	12024-00	Centre of remote sensing and geoinformatics in agriculture	2012	Dept. of Soil & Water Constr. Engg., CAET, Junagadh
44	12025-00	Recycling of organic waste for sustainable soil productivity under dry land agri. at Targhadia	2012	Main Dry Farming Research Station, Targhadia
45	12026-00	Project for research on forage crop production at Dhari	2012	Grassland Res. Station, Dhari
46	12028-00	<i>Aflatoxin</i> and its management in groundnut in Saurashtra region of Gujarat	2013	Main Oilseed Research Station, Junagadh
47	12029-00	Molecular mapping of important traits and their transfer through Marker Assisted Selection (MAS) in groundnut and cotton	2013	Dept. of Biochemistry, Junagadh
48	12030-00	Studies on effect of climate change on fruit crops of Saurashtra region	2013	Dept. of Horticulture, Junagadh
49	12303-05	Establishment of Gir cattle & Jaffrabadi buffaloes	1996	Cattle Breeding Farm, Junagadh
50	12953-00	Strengthening of livestock & veterinary component	2002	Cattle Breeding Farm, Junagadh
51	12303-14	Integrated farming system (Integrated farming combining crop livestock bio resources)	2009	Cattle Breeding Farm, Junagadh

52	12303-15	Establishment of bull mother farm of Gir cattle & Jaffrabadi buffaloes	2011	Cattle Breeding Farm, Junagadh
53	12950-00	Establishment and devp. of res. in fisheries	2000	Fisheries Res. Station, Okha
54	12577-00	Value added products from fish/ shelifish	2006	College of Fish. Sci., Veraval
55	12578-00	Establishment of inland fishery research centre	2006	Inland Fisheries Research Station, Junagadh
56	12579-00	Establishment of pearl oyster hatchery	2009	Fisheries Res. Station, Sikka
57	12581-00	Feasibility of mass culture of marine red algae <i>Kappaphycus alvarezii</i> (Schimitz) on the Saurashtra region at west coast of India	2009	Fisheries Research Station, Okha
58	12016-00	Establishment of aqua-based research and training centre in coastal Saurashtra at Mahuva	2011	Agricultural Research Station (FC), Mahuva
59	12031-00	Crop improvement in papaya at Junagadh	2014	Dept. of Horti., Junagadh
60	12032-00	Integrated pest management in seed spices at Junagadh	2014	Dept. of Entomology, Junagadh
61	12033-00	Evaluation of pharmacological activity of indigenous medicinal plants of Saurashtra region	2014	College of Veterinary Science & Animal Husbandry, Junagadh
62	12034-00	Identification & documentation of marine fish biodiversity using mitochondrial DNA bar coding at Veraval	2014	College of Fisheries Science, Veraval

**(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
			1985	Main Pearl Millet Research Station, Jamnagar
	5008	Scheme for oilseed research	1979	Sugarcane Res. Station, Kodinar
			1979	Oilseed Res. Station, Manavdar



7	5009	Scheme for strengthening of research in cotton investigation of fiber crops other than cotton, development of remie fiber.	1985	Agril. Research Station, Amreli
			1985	Cotton Research Station, Khapat
			2002	Cotton Research Station, Junagadh
8	5011	Scheme for research in sugarcane	1971	Sugarcane Res. Station, Kodinar
9	5012	Scheme for research in grasses forage	1985	Grassland Res. Station, Dhari
10	5013	Strengthening of research in vegetable (Tomato)	1962	Vegetable Research Station, Junagadh
11	5014	Scheme for research and improvement in fruit crops	1961-62	Fruit Research Station, Mangrol
				Agril. Res. Station (FC), Mahuva
				Dept. of Horticulture, Junagadh
12	5018	Scheme for res. studies in agri. economics	1972	Dep. of Agril. Eco., Junagadh
13	5020	Scheme for research in agriculture chemistry & soil science	1972	Dept. of Agril. Chemistry & Soil Science, JAU, Junagadh
14	5025	Project for the research in agronomy and crop husbandry	2005	Dept. of Agronomy, Junagadh
15	5026	Project for the research in pest control and other entomological aspect	1960	Dept. of Entomology, Junagadh
16	5042	Strengthening of dry farming research station	1965	Dry Farming Res. Station, Ratia
			1979	Main Dry Farming Research Station, Targhadia
			1967	Dry Farming Research Station, Jam-Khambhalia
			1964	Dry Farming Research Station, Vallbhipur
			2011	Cotton Res. Stat., JAU, Kukada
			1975	Grassland & Agril. Research Station, 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 Extension and Advisory Committee (ZREAC)

This committee is functioning at Zonal level of South Saurashtra & North Saurashtra agro-climatic zones and two meetings are organized in the year viz., kharif and rabi summer. The research programs/works carried out in different schemes/projects are presented by scientists in the meeting. The power point presentations are made in the house for thorough discussion and refinement of each ongoing project. In this meeting scientists form

different disciplines as well as officers from line departments are participating and debating on the results of the projects as well as suggest improvement in new technical programs for future research work. The officers from the line departments are also presenting feedback as well as overall agriculture situations in their regions. They also suggest the inputs for new area of research. It is the multidisciplinary task to evaluate the research results of different disciplines.





During the year 2019-20, four meetings of ZREAC were organized; two each at Junagadh and Targhadia. In the ZREAC meetings, four crop varieties, fifty three farmers' recommendations,

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

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

Meeting	Place	Date	No. of Recommendations approved		New Technical Programs
			Farmers	Scientific	
31 <sup>st</sup> ZREAC ( <i>Rabi-summer</i> ) of North Saurashtra Agro-climatic Zone	Targhadia	October 10, 2019	02	01	-
31 <sup>st</sup> ZREAC ( <i>Rabi-summer</i> ) of South Saurashtra Agro-climatic Zone	Junagadh	October 18-19, 2019	01*+16	09	32
32 <sup>nd</sup> ZREAC ( <i>kharif</i> ) of South Saurashtra Agro-climatic Zone	Junagadh	January 16-17, 2020	02*+32	13	45
32 <sup>nd</sup> ZREAC ( <i>kharif</i> ) of North Saurashtra Agro-climatic Zone	Targhadia	January 27, 2020	01*+03	05	13
<b>Total</b>			<b>04*+53</b>	<b>28</b>	<b>90</b>

\*Indicate no. of varieties released

**Agricultural Research Sub Committee (AGRESCO - Discipline wise)**

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

**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 and maintenance breeding programme.
Crop Production	Agronomy, Agricultural Chemistry & Soil Science, Weed Control
Plant Protection	Entomology & Plant Pathology
Horticulture & Agro Forestry	Fruits, Vegetables, Flowers and Spices
Agricultural Engineering	Soil & Water Conservation Engineering, Farm Machinery & Power Engg., Renewable Energy Engineering, Processing & Food Engineering
Animal Science and Fisheries Science	Animal Breeding, Animal Nutrition, Livestock Production & Management, Anatomy, Medicine & Surgery, Animal Genetics <i>etc.</i> Fisheries Resource Management, Post-harvest Technology, Aquatic Environment, Aquaculture, Fishery Hydrology and Fishery 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
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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 will refine the reports, recommendations and new programs for ensuing season. The suggestions made in the meetings are incorporated in the reports. The committee is consisting of senior scientists as a member. Hence, the proposals and programs pertaining to the various disciplines are discussed critically. The conveners of various sub committees present the proceedings in the Joint AGRESKO meeting.



Various Agricultural Research Sub Committee meetings were held during February to March 2020 at Junagadh. A total four new crop varieties, fifty two farmers' recommendations, thirty five scientific

recommendations and seventy eight 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 AGRESKO (Discipline wise) subcommittee meetings organized**

Sub Committee	Date	No. of Recommendations		New Technical	On-going Research
		Farmers		Scientific	
Basic Science	February 06-07, 2020	01	02	06	39
Agricultural Engineering	February 17-18, 2020	10	01	07	34
Animal Science & Fisheries Science	February 17-18, 2020	02	04	10	38
Social Science	February 19, 2020	-	08	08	24





Plant Protection	February 25-26, 2020	20	14	13	352
Horticulture & Agro Forestry	February 28, 2020	05	-	05	26
Crop Production	March 03-04, 2020	12	06	28	153
Crop Improvement	March 05-06, 2020	04*+02	-	02	-
	<b>Total</b>	<b>04*+52</b>	<b>35</b>	<b>79</b>	<b>666</b>

\*Variety released

### Joint Agricultural Research Sub Committee (Joint AGRESCO)

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 AGRESCO present the findings of their respective committees for approval. This committee meeting is presided over by the Hon'ble Vice Chancellor. Joint AGRESCO will finalize the recommendations and new technical programs for research, which was presented in the ensuring 16th Combined Joint AGRESCO of State Agricultural Universities.

The 16th Joint AGRESCO meeting was held at College of Agricultural Engineering & Technology, JAU, Junagadh on April 16, 2020 under the chairmanship of Dr. V. P. Chovatia, Hon'ble Vice Chancellor, JAU, Junagadh. All AGRESCO conveners of various committees presented their reports and approved. four new crop varieties, fifty two farmers' recommendations, thirty five scientific recommendations and eighty two new technical programs were approved in the meeting.

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

This is the apex body to finalize the research recommendations 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 AGRESCO 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 AGRESCO subcommittee present the reports of their respective universities. In the concluding session, the conveners from each subcommittee present the final report of research in the meeting. The output of research in the form of recommendations/ technologies is published in the form of proceedings and supplied to the all concerned for implementation.

The 16<sup>th</sup> Combined Meeting of Agricultural Research Council (AGRESCO-2020) of SAUs and Kamdhenu University was held through online mode, organized and handled by Navsari Agricultural University, Navsari during different schedules at different days. Firstly meetings for new technical programmes were organized during May 19 - June 10, 2020 and after that meetings for recommendations/varieties were organized during June 18-July 09, 2020. Hon'ble Vice Chancellors of JAU, AAU, NAU, SDAU and KU namely Dr. V. P. Chovatia, Dr. R. V. Vyas, Dr. S. R. Chaudhary, Dr. R. K. Patel and Dr. N. H. Kelawala were remained present and graced the occasion.



During 16<sup>th</sup> Combined Joint AGRESKO meeting, four new crop varieties viz. Groundnut (GG 23 and GG-35), Pearl millet (GHB-1231) and Brinjal (GRB-7) of JAU were recommended for release in the state. Besides, forty six technologies/ recommendations were made for farmers and twenty

eight recommendations were made for scientific community. In addition, as many as seventy nine 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 16th Combined Joint AGRESKO meeting of SAUs**

Sub Committee	No. of Recommendations		New Technical Programs
	Farmers	Scientific	
Crop Improvement	04*+02	-	01
Crop Production	11	03	28
Plant Protection	19	12	16
Horticulture & Agro Forestry	03	01	03
Agricultural Engineering	08	02	07
Animal Science	-	04	09
Fisheries Science	01	-	01
Basic Science	01	02	06
Social Science	-	04	08
Dairy Science	01	-	-
<b>Total</b>	<b>04*+46</b>	<b>28</b>	<b>79</b>

\*Variety 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 in India are organized. A total of 20 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.



**Monitoring of AICRP of Wheat and Cotton at JAU, Junagadh**



**Monitoring of AICRP of Chickpea and Castor at JAU, Junagadh**



**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 Indigenous Cattle (Gir)-Germplasm & Data Recording Unit	Cattle Breeding Farm, Junagadh	April 01-03, 2019	1. Dr. V. K. Taneja, Ex. DDG (AS), Ex. Vice Chancellor and Chairman 2. Dr. S. K. Agarwal, Ex. Director, ICAR-CIRG, Mathura, U.P 3. Dr. S. Tyagi, Principal Scientist & In charge, PME Cell and Dr. Umesh Singh, Head Division of Cattle Genetics & Br., In charge, AICRP on Cattle, ICAR-CIRC, Meerut, U.P.
ICAR-AICRP on Pearl Millet	Main Pearl millet Research Station, Jamnagar	September 29, 2019	Dr. L. D. Sharma (Breeder), Prof.; Dr. A. C. Mathur (Patho.), Assoc. Res Sci. and Dr. R. S. Bajia (Ento.), SRA, RARI, SKNAU, Jaipur
AICRP on Soybean	Agricultural Research Station, Amreli	September 29, 2019	1. Dr. M. K. Shrivastava, Principal Scientist, JNKVV, Jabalpur 2. Dr. R. Channakeshava, Sci., IISR, Indore
ICAR seed project: Seed production in agril. crops	Department of Seed Science & Technology, Junagadh	October 14, 2019	1. Dr. Basave Gowda, Special Officer (seeds) & Convener, UAS, Raichur 2. Dr. Manja Naik, Member, UAS, Bengaluru 3. Dr. Ramesh K. V., Member, ICAR-IISS, Mau
AICRP- National Seed Project (Crops) Seed Tech. Research	Main Pearl millet Research Station, Jamnagar	October 15, 2019	
AICRP on Groundnut	Main Oilseeds Research Station, Junagadh	October 16-17, 2019	Dr. O. Venkateswar, Principal G'nut Breeder; Dr. K. Vemana, Plant Pathologist and Dr. E. Venkateswar, G'nut Breeder, ARS, Kadari
AICCIP on Cotton	Cotton Research Station, Junagadh	November 04-05, 2019	1. Dr. D. Monga, Head, ICAR-CICR, RS, Sirsa 2. Dr. Paramjit Singh, Director, PAU, RS, Bathinda 3. Dr. B. S. Nayak, Officer-in-Charge, ICAR-AICRP on Cotton, RRTTS (OUAT), Bhawanipatna 4. Dr. Rishi Kumar, Principal Scientist, ICAR-CICR, RS, Sirsa 5. Dr. C Karpagam, Senior Scientist, ICAR-CICR, RS, Coimbatore
AICRP on Castor	Main Oilseeds Research Station, Junagadh	November 17-18, 2019	1. Dr. M. Santhalakshmi Prasad, Principal Sci. (Pl. Patho.), ICAR-IIOR, Hyderabad 2. Dr. K. Sadaiah, Jr. Breeder and Dr. N. Nalini, Jr. Agronomist PJTSAU, Palem 3. Dr. Ramesh, Jr. Breeder, RAU, Mandor 4. Dr. D. N. Tejani, Jr. Entomologist, SDAU, S. K. Nagar

AICRP on Post-Harvest Engg. & Tech.	Dept. of Processing & Food Engg., CAET, Junagadh	December 07-12, 2019	Dr. S. K. Tyagi, Project Co-coordinator, AICRP on PHET, CIPHET, Ludhiana
AICRP on Irrigation Water Management	Dept. of Soil & Water Conservation Engg., CAET, Junagadh	January 06-07, 2020	Sri Venkateswara Rao, Dist. Ground Water Officer; Sri M. Rama Rao, Asstt. Dir.; Sri R. S. Narsimha Rao, Dist. Ground Water Officer; Sri G. Narsimlu, Asstt. Dir.; Sri K. Srinivas, Dist. Ground Water Officer; Sri Madhva Rao, Asstt. Geophysicist; Sri G. Sudhir Reddy, Dy. Dir. of Agri.; Sri P Chandra Shekhar, Training Coordinator and Dr. D. K. Dobariya, Liaison Officer, WALMI, Anand
AICRP on Chick pea	Pulses Research Station, Junagadh	January 23, 2020	Dr. Ritu R. Saxena, Scientist & I/c AICRP on Chickpea; Dr. N. Khare, Pr. Scientist (Patho.) and Dr. G. P. Banjara, Sr. Scientist (Agro.), IGKVV, Krishaknagar, Raipur, Chhattisgarh
Network Project on Buffalo Improvement (Jaffrabadi)	Cattle Breeding Farm, Junagadh	February 07-08, 2020	Dr. S. S. Dahiya, Director and Dr. K. P. Singh Principal Sci., Central Institute for Research on Buffaloes (ICAR-CIRB), Hisar, Haryana
AICRP on Wheat	Wheat Research Station, Junagadh	February 21, 2020	1. Dr. S. V. Sai Prasad, Head, and Dr. Divya Ambati, Sci., ICAR-IARI, RS, Indore 2. Dr. Sindhu Sarin, Principal Scientist and Dr. K. Venkatesh, Senior Sci., IIWBR, Karnal 3. Dr. S. I. Patel, Assoc. Research Scientist, SDAU, Vijapur 4. Dr. M. A. Gud, Asstt. Res. Scientist, MPKV, RWRRS, Mahabaleshwar

**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 germ plasm 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)
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	2002-03	National surveillance program for aquatic animal diseases	2013	ICAR-Network	College of Fisheries Science, Veraval
16	2002-5	Implementation of protection of plant varieties and farmer's rights legislation	2002	ICAR-Network	Main Pearl millet Res. Station, Jamnagar
17	2004-1	Project for frontline demonstration in wheat		ICAR-Network	Wheat Research Station, Junagadh
18	2008-3	Project for frontline demonstration in sesame	2007	ICAR-Network	Agriculture Research Station, Amreli
19	2008-12	Scheme for breeder seed production of oilseeds crops (ICAR revolving fund)	2007	ICAR-Network	Main Oilseed Research Station, Junagadh
20	2009-6	Front line demonstration on cotton	2001	ICAR-Network	Cotton Research Station, Junagadh
21	2254	Study storage losses of food grains	2013	ICAR-Network	Dept. of PFE, CAET, Junagadh
22	2374-1	FLD on Chickpea	-	ICAR-Network	Pulses Research Station, Junagadh
23	2374-6	FLD on Pigeon pea			
24	2504-00	Revolving fund horticulture (Nursery)	-	ICAR-Network	Dept. of Horticulture,

25	2704-40	Project for frontline demonstration on groundnut	1999	ICAR-Network	Main Oilseed Res. Station, Junagadh/ Agril. Research Station, Amreli
26	2704-43	Project for frontline demonstration in pearl millet	1989	ICAR-Network	Main Pearl millet Research Station, Jamnagar
27	2002-07	Consortia research platform (CRP) on biofortification	2014		
28	18132	Creation of seed-hubs for increasing indigenous production of pulses in India	2016	ICAR-Network	Dept. of Seed Science & Tech., Junagadh
29	18303-14	Technical assistance for wild life health care, diseases diagnosis and therapeutic management	2017	GOG	College of Veterinary Science & Animal Husbandry, Junagadh
30	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
31	18009-33	Proliferation of Bt-gene in native cotton varieties of Gujarat	2017	GOG	Cotton Research Station, Junagadh
32	2009-09	Testing of Bt. Cotton	2017	ICAR	Cotton Res. Stat., Junagadh
33	18246-91	River flow simulations integrating satellite data in forested catchment	2017	GOG	CAET, JAU, Junagadh
34	18009-34	Seed infrastructure under NMOOP	2017	GOG	Agril. Res. Station, Amreli
35	1855-03	Mapping and valuation of economics, social and environmental benefits of conserving Gir Forest area	2018	GOG	Dept. of Economics, JAU, Junagadh
36	18024-14	To identify the candidate biocontrol agent putatively involved in biological control of plant disease	2018	GOI	Dept. of Biotechnology, JAU, Junagadh
37	2009-07	Insecticide Resistance Management: Dissemination of pink bollworm management strategies	2018	ICAR	Cotton Research Station, JAU, Junagadh
38	18132-02	Creation of Seed-Hubs for Enhancing Quality Seeds Availability of Major Oilseeds Crops - Groundnut under NFSM - Oilseed mission	2018	GOI	Department of Seed Science & Technology, JAU, Junagadh
39	2008-08	Project for Production of Breeder Seed of Annual Oilseeds Crops.	1987	ICAR	Main Oilseed Research Station, 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 also produced to fulfill the demand of private and public

sectors as per the national and state indents under coordination of Mega Seed unit and concern crop scientist are given in following table. The required nucleus seeds of different crops were also produced for the breeder seed production in the ensuing season.

**Table 4.3.1 Production of Nucleus / Breeder Seeds**

SN	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
1	Groundnut	GG-2	1.20	-	42.00	43.20
		GG-5	2.60	-	64.00	66.60
		GG-7	1.50	-	27.00	28.50
		GJG-9	4.50	30.00	131.40	165.90
		GJG-31	6.00	85.20	157.20	248.40
		GJG-32	12.00	130.00	147.35	289.35
		GAUG-10	4.20	-	115.90	120.10
		GG-11	6.00	-	61.90	67.90
		GJG-17	6.00	-	119.40	125.40
		GJG-18	4.00	70.10	-	74.10
		GG-20	22.50	60.00	1340.10	1422.60
		GG-21	2.40	-	9.90	12.30
		GJG-22	15.60	-	1139.70	1155.30
		GJG HPS-1	2.40	-	3.60	6.00
	<b>Sub Total</b>	<b>90.90</b>	<b>375.30</b>	<b>3359.45</b>	<b>3825.65</b>	
2	Pearl millet	GHB 538	0.04	0.20	0.16	0.40
		GHB 744	0.03	0.35	-	0.38
		GHB 732	-	-	0.60	0.60
		GHB 905	0.07	1.00	-	1.07
		<b>Sub Total</b>	<b>0.14</b>	<b>1.55</b>	<b>0.76</b>	<b>2.45</b>
3	Sesame	G. Til-1	0.05	-	-	0.05
		G. Til-2	0.50	0.22	-	0.72
		G. Til-3	0.30	3.75	1.75	5.80
		G. Til-4	0.30	0.41	2.54	3.25
		GJT-5	0.15	0.30	0.53	0.98
		G. Til-6	0.10	2.00	-	2.10
		G. Til-10	0.10	0.30	0.35	0.75
		<b>Sub Total</b>	<b>1.50</b>	<b>6.98</b>	<b>5.17</b>	<b>13.65</b>



4	Chickpea	GG 1	2.05	-	13.25	15.3
		GG 2	1.60*	-	8.00*	9.6
		GJG 3	7.25	-	142.85*	150.10
		GG 4	2.00	4.95	-	6.95
		GG 5	2.82	-	79.50	82.32
		GJG 6	8.42	31.5	31.5	71.42
		<b>Sub Total</b>	<b>24.14</b>	<b>36.45</b>	<b>275.10</b>	<b>335.69</b>
5	Pigeon pea	GJP 1	0.24	0.30	9.00	9.54
		<b>Sub Total</b>	<b>0.24</b>	<b>0.30</b>	<b>9.00</b>	<b>9.54</b>
6	Wheat	GW 366	14.00	446.80	15.00	475.80
		GJW 463	2.00	8.00	38.00	48.00
		GW 496	-	-	52.00	52.00
		Lok 1	-	-	24.40	24.40
		<b>Sub Total</b>	<b>16.00</b>	<b>454.80</b>	<b>129.40</b>	<b>600.20</b>
		<b>Grand total</b>	<b>132.92</b>	<b>875.38</b>	<b>3778.88</b>	<b>4787.18</b>

#### \*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 details are given in below table. Very good response was observed among the farmers to avail this facility.

**Table 4.3.2 Production of 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	627.81	230.10	1137.90
2	Chickpea	187.22	60.00	1282.50
3	Sesame	15.57	-	-
4	Wheat	170.50	-	1575.00
5	Cotton	51.00	-	-
6	Castor	15.00	-	-
7	Cumin	38.50	-	-
8	Coriander	90.00	-	-
9	Soybean	109.73	-	-
10	Mungbean	14.40	-	-
11	Urdbean	27.22	-	-
12	Pigeon pea	10.00	17.60	220.80
13	Sugarcane Setts	800.00	-	-
14	Sorghum	30.00	-	-
	<b>Total</b>	<b>2186.95</b>	<b>307.70</b>	<b>4216.20</b>

### New crop varieties

Four new crop varieties viz. Groundnut (GG 23 and GG-35), Pearl millet (GHB-1231) and Brinjal (GRB-7) were recommended for farmers of the state during the year 2019-20.

#### Groundnut Variety: Gujarat Groundnut-23 (GG-23: Sorath Kiran)

The farmers of Gujarat state growing groundnut during kharif season are advised to grow virginia bunch groundnut variety Gujarat Groundnut 23 (GG 23). This variety has recorded mean pod yield of 2800 kg/ha, which was 13.85 and 17.17 % higher over the check varieties, GJG 22 (2459 kg/ha) and GG 20 (2390 kg/ha), respectively. This variety has also recorded higher kernel yield, oil yield and number of pods per plant over the check varieties. This variety was found comparable to the check varieties against tikka, rust, stem rot and collar rot diseases. The damage due to leaf defoliators was lower in GG 23 than the check varieties



#### Groundnut variety: Gujarat Groundnut-35 (GG-35: Sorath Gold)

The farmers of Gujarat state growing groundnut during kharif season are advised to grow Spanish bunch groundnut variety Gujarat Groundnut 35 (GG 35). This variety has recorded mean pod yield of 3177 kg/ha, which was 29.54, 28.59 and 15.17 % higher over the check varieties, GG 7 (2452 kg/ha), GJG 9 (2471 kg/ha) and TG 37A (2758 kg/ha), respectively. This variety has also recorded high kernel yield, oil yield and number of pods per plant over the check

varieties. This variety was found comparable to the check varieties against tikka, rust, stem rot and collar rot diseases. The damage due to leaf defoliators was also lower in GG 35 than the check varieties.



#### Brinjal variety: Gujarat Round Brinjal -7 (GRB-7: Sorath Ravaiya)

The farmers of Gujarat State growing brinjal crop during late kharif season (15th August to 15th September) are advised to grow brinjal variety Gujarat Round Brinjal-7 (GRB-7). The proposed variety has recorded the mean fruit yield of 401.46 q/ha, which was 20.47, 30.61 and 28.68 per cent higher over check varieties; GJB-3 (333.25 q/ha), GRB-5 (297.30 q/ha) and GNRB-1 (301.74 q/ha), respectively. The fruits of GRB-7 are medium in size with round shape and pink purple in colour and good shining. This variety contains higher protein content. The variety has cluster fruit bearing habit. The proposed variety was found comparable with checks for insect-pests and diseases.







### Pearl Millet Hybrid: Gujarat Hybrid Bajara-1231 (GHB-1231: Sorath Shakti)

The farmers of Gujarat state growing pearl millet during kharif season are recommended to grow GHB 1231 as a late type dual purpose (grain and fodder) bio-fortified hybrid. This hybrid recorded mean grain yield of 2760 kg/ha which was 9.22 per cent higher than check hybrid GHB 732 (2527 kg/ha). It has also recorded 7471 kg/ha dry fodder yield which was 16.1 per cent higher than check hybrid GHB 732 (6434 kg/ha). This hybrid also gave higher grain and dry fodder yield than public sector check hybrid GHB 558 and private sector check hybrid. The proposed hybrid is resistant to major pearl millet disease and pest. The grain of this hybrid possess higher content of Fe and Zn (> 70 PPM and > 40 PPM) which is additional benefit of pearl millet to the farming and consumer community for their nutritional security.



### Recommendation for Farmers

#### Effect of micronutrient application on seed yield and quality of coriander (*Coriandrum sativum* L.)

The farmers of South Saurashtra Agro-climatic



Zone associated with seed production of coriander are advised to apply  $\text{FeSO}_4$  @ 25 kg/ha as soil application at the time of sowing or foliar application of  $\text{FeSO}_4$  @ 0.5 % (75 g/15 litre) + 0.1 % Citric Acid (15 g/15 litre) at 30 & 45 DAS in addition to recommended dose of fertilizer (20:10:0 NPK kg/ha) to obtain higher seed yield with high germination and seedling vigour.

#### Study the fresh seed dormancy in sesame

Sesame growing farmers of Saurashtra region are advised that freshly harvested seeds of white seeded sesame varieties GT-2, GT-3, TKG 22, Pragati and GT-5 produced in the previous season, could not be utilized for sowing, as seed dormancy was found in these varieties and it was released after 115, 115, 95, 105 and 105 days after harvesting, respectively.



However, black seeded variety GT 10 could be utilized for sowing in the next season, as it released the dormancy of 35 days after harvesting (DAH).

### 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.





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 & Irrigation Water Sample**

Sr. No.	Name of Research Station/ Department	Number of Sample
1	Soil sample analysis	2987
2	Irrigation water analysis	1419
3	Plant sample analysis	53329
<b>Total</b>		<b>57735</b>

### Recommendation for Farmers

#### Nutrient Management

#### Evaluation of different kharif groundnut varieties under organic farming

The farmers of South Saurashtra Agro-climatic Zone growing kharif bunch groundnut under organic farming are recommended to apply 50 % RDN through FYM (1250 kg/ha) + 50 % RDN through vermicompost (312.50 kg/ha) for higher pod yield and net return.



#### Application of bio-formulations in kharif groundnut production

The farmers of South Saurashtra Agro-climatic Zone growing groundnut during kharif season are recommended to apply 75 % recommended dose of chemical fertilizers (9.37-18.75-37.5 kg NPK/ha) with seed treatment of NPK liquid bio-fertilizer (250 ml for seed of 1 ha) + Zn solubilizing bacteria (125 ml for seed of 1 ha) for obtaining higher pod yield and net return.



#### Nutrient and pest management in pigeon pea

The farmers of South Saurashtra Agro-climatic Zone, growing kharif pigeon pea are recommended to apply recommended dose of fertilizer (25-50-50 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) and spray of indoxacarb 14.5 SC 0.010 % (7 ml/10 L of water) at 50 % flowering and spray of chlorantraniliprole 18.5 SC 0.006 % (3 ml/10 L of water) 15 days after 1st spray.

Alternatively, apply recommended dose of fertilizer (25-50-50 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) and spray of multi micronutrient formulation Grade IV 20 ml/10 liter and spray of indoxacarb 14.5 SC 0.010 % (7 ml/10 L of water) at 50 % flowering and spray of chlorantraniliprole 18.5 SC 0.006 % (3 ml/10 L of water) 15 days after 1st spray for obtaining higher seed yield and net realization.





## Recommendation for PHI as per CIB guidelines

Year	Crop	Pest	Pesticides with formulation	Dosage			Dilution in water	Application schedule	Waiting period/ PHI (days)
				g a.i./ ha	Quantity of formulation (g or ml/ha)	Conc. (%)			
2020	Kharif pigeon pea	Pod borer complex	Indoxacarb 14.5 SC	50.75	350	0.010	500 liters	First spray at 50 % flowering	15
			Chlorantraniliprole 18.5 SC	27.75	150	0.006		Spray at 15 days interval after 1 <sup>st</sup> spray	29

### Effect of mulching and hydrogel on the productivity of pearl millet in rainfed condition



The farmers of North Saurashtra Agro-climatic Zone growing pearl millet in kharif season are recommended to apply hydrogel (350 µm mesh) 2.5 kg/ha as soil application at the time of sowing + pearl millet straw mulch 5.0 t/ha at 30 days after sowing for getting higher yield and net returns and improving moisture availability in soil.

### Effect of multi-micronutrient formulations on papaya



The farmers of South Saurashtra Agro-climatic Zone growing papaya in medium black calcareous soil are recommended to apply multi micronutrients

formulation Grade-V (40 g/plant) as basal or micronutrient as per soil test value in addition to recommended dose of chemical fertilizers (200-200-250 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O g/plant) as well as 5 kg FYM/plant to papaya for getting higher yield and net return.

### Effect of nano boron on yield and nutrients uptake by kharif groundnut



The farmers of South Saurashtra Agro-climatic Zone growing kharif groundnut in medium black calcareous soil are recommended to apply three sprays of 0.2 % boric acid OR 0.2 % nano boron (20 ml/10 lit water) at 30, 45 and 60 DAS in addition to recommended dose of fertilizers (12.5-25-50 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) to kharif groundnut for getting higher yield and net return.

### Effect of N, P and K levels on growth, yield and nutrients uptake by coriander

The farmers of South Saurashtra Agro-climatic Zone growing coriander are recommended to apply 40 kg N/ha in two equal splits (½ as basal and ½ at 30 DAS), 30 kg P<sub>2</sub>O<sub>5</sub>/ha and 20 kg K<sub>2</sub>O/ha as basal for getting higher seed yield and net return.



## Cultural Practices

### Influence of plant geometry and fertilizer levels on the productivity of semi-spreading groundnut

The farmers of South Saurashtra Agro-climatic Zone growing semi-spreading groundnut during kharif are recommended to sow at a spacing of 45 cm x 10 cm (seed rate 135 kg/ha) and apply either 50 % RDF (6.25-12.5-25 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) + 50 % RDN through FYM (1250 kg/ha) + Bio-fertilizer (Rhizobium 10 ml/kg seed, PSB & KMB soil application 3.0 liter/ha) or 100 % RDF (12.5-25-50 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) + Bio-fertilizer (*Rhizobium* 10 ml/kg seed, *PSB* & *KMB* soil application 3.0 liter/ha) for obtaining higher pod yield and net return.



### Screening of sesame varieties/germplasm lines for yield performance under organic condition in summer season



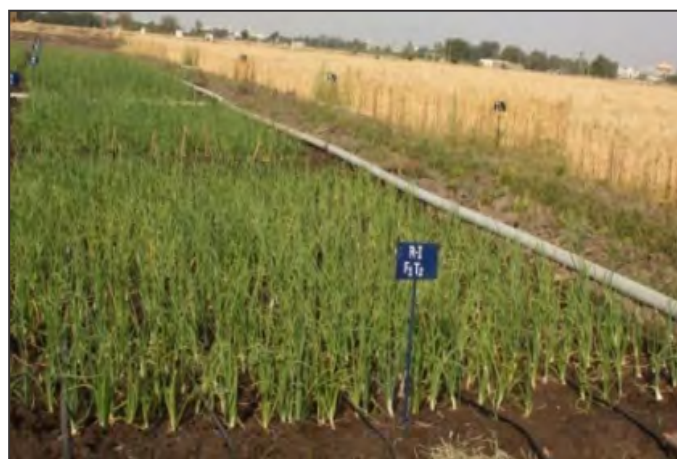
The farmers of South Saurashtra Agro-climatic Zone of Gujarat state interested to grow summer sesame in organic condition are recommended to grow sesame variety G. Til 4 or GJT 5 or G. Til 6 for achieving higher seed yield.



## Irrigation Management

Response of rabi onion (*Allium cepa* L.) to levels and application schedule of soluble fertilizers under drip irrigation

The farmers of South Saurashtra Agro-climatic Zone growing rabi onion (Cv. Pilipatti) are recommended to apply 5 t FYM/ha along with 75 % RDF (i.e. 56.25-45.00-37.50 kg N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O/ha) in water soluble form through drip fertigation in six equal splits at 10 days interval after two common flood irrigations for getting higher yield and net return.





Details of drip system Particular	Detail	Particular	Detail
Lateral spacing	90 cm	Dripper distance	40 cm
Operation pressure	1.2 kg/cm <sup>2</sup>	Irrigation interval	Alternate day
Dripper discharge rate	4 l/h		

### Weed Management

#### Integrated weed management in soybean

The farmers of south Saurashtra Agro-climatic zone growing soybean are recommended to apply pre-mix pendimethalin + imazethapyr 800 g/ha (30 + 2 % EC 50 ml/10 l water) as pre-emergence fb IC & HW at 40 DAS or IC & HW at 20 & 40 DAS for effective weed management and achieving higher seed yield and net realization.



#### Recommendation for Scientific Community

Screening of sesame varieties/germplasm lines for yield performance under organic condition in summer season

It is for the information of scientific community that under South Saurashtra Agro-climatic Zone of

Gujarat state sesame varieties/germplasm GT 4, AT 319, GJT 5 and GT 6 gave higher seed yield in summer season under organic condition.



#### Management of chickpea crop under organic farming

It is for the information of scientific community that under South Saurashtra Agro-climatic Zone, application of FYM @ 4 t/ha + vermicompost 1.0 t/ha + either *Trichoderma harzianum* (2 x 10<sup>7</sup> cfu/g) @ 2.5 kg/ha or *Pseudomonas fluorescens* (1 x 10<sup>8</sup> cfu/g) 2.5 kg/ha + *Rhizobium* culture (1 x 10<sup>7</sup> cfu/g) 5 ml/kg seed + PSB (1 x 10<sup>7</sup> cfu/g) 5 ml/kg seed + two spray of *Beauveria bassiana* (2 x 10<sup>6</sup> cfu/g) 40 g/10 L water at 50 % flowering and 2nd spray at 15 days after 1st spray found the most economical in chickpea.



### Relative salinity tolerance of different pigeon pea varieties

It is for the information of scientific community especially plant breeders that pigeon pea variety GJP 1 was found more salt tolerance [higher mean salinity index (60.04), higher mean seed yield (22.66 g/plant), minimum yield decline (66.45 %) at 8.0 dS/m and for 50 % yield reduction at EC 6.86 dS/m, as well as lower Na/K ratio in seed and stalk] compared to AGT 2 and GT 101 on the basis of salinity indices. The sequential order of salinity tolerance for pigeon pea varieties was observed as GJP 1 > BDN 2 > Vaishali > GT 101 > AGT 2.



### 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.

#### 4.5.1 Production of Sawaj brand bio-agents and microbial products

During the year 2019-20, Department of Plant Pathology has produced and distributed bio-agents under the trade name "Gir Sawaj" as shown in table below. *Trichoderma harzianum* used for the management of various soil borne disease especially stem and pod rot of groundnut in the Saurashtra region. 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 bio-agent and liquid bio-fertilizer

Sr. No	Name of Product	Quantity
1	<i>Trichoderma</i> (tonne)	215.39
2	<i>Rhizobium</i> (liter)	2114
3	<i>Azotobacter</i> (liter)	1674
4	PSB (liter)	3372
5	KMB (liter)	420

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* (HNVPV), *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 microbial agents, traps, lure etc.

Sr. No.	Name of product	Quantity
1	<i>Beauveria</i> (tonne)	89.55
2	<i>Metarhizium</i> (kg)	6111
3	HNVPV (liter)	193
4	SNPV (liter)	101
5	Trichocard (Nos.)	480
6	Fruit fly traps (Nos.)	5289
7	Fruit fly lure for fruit crops (Nos.)	6039
8	Fruit fly lure for vegetable crops (Nos.)	1216
9	Pheromone Trap (Nos.)	59439
10	Pheromone Lure (Pink bollworm) (Nos.)	107135
11	Pheromone Lure ( <i>Heliothis</i> ) (Nos.)	10159



12	Pheromone Lure (Prodenia) (Nos.)	3638
13	Pheromone Lure (Brinjal shoot and fruit borer) (Nos.)	906

14	MDP Technology for Pink bollworm (100 gm Tube)	735
15	Honey (litre)	428

### Recommendation for Farmers

#### Entomology

#### Evaluation of new pheromone based mating disruption technology for shoot and fruit borer in brinjal

The farmers of South Saurashtra Agro-climatic Zone growing brinjal are advised to give three

applications of Gir Sawaj Mating Disruption Paste @ 400 g per application per hectare (uniformly distributed in 1000 dots between two branches), first at initiation of pest infestation and successive two application at an interval of 30 days for effective, economical and ecofriendly management of brinjal shoot and fruit borer.

Year	Crop	Pest	Pesticides with Formu-lation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule
				g.a.i./ha	Qty. of formulation /ha	Conc. (%)	Dilution in water (10 lit.)		
2020	Brinjal	Shoot and fruit borer	Gir Sawaj Mating Disruption Paste	-	400 g paste per application per hectare	-	-	-	First application at pest infestation, while second and third at 30 days interval after first application.

#### Impact of bio-pesticides and insecticides on foraging bee in mustard

The farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of *Beauveria bassiana* 1.15 WP (Min.  $1 \times 10^8$  cfu/g) 0.0069 %

(60 g/10 lit. of water), first at initiation of aphid and second at 15 days after first spray. *Beauveria bassiana* 1.15 WP found safer for foraging activities of bees in mustard.

Year	Crop	Pest	Pesticides with Formu-lation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule
				g.a.i./ha	Qty. of formulation /ha	Conc. (%)	Dilution in water (10 lit.)		
2020	Mustard	Foraging bees	<i>B. bassiana</i> 1.15 WP	35	3.0 kg	0.0069 (Min. $1 \times 10^8$ cfu/g)	60 g	500 lit.	First spray at initiation of aphid and second spray at 15 days after first spray

#### Study on foraging activities of honeybees on seed spices

The farmers of South Saurashtra Agro-climatic Zone are advised to avoid the insecticidal spray

during visiting time of honey bees from 12.00 to 16.00 hours on coriander, fennel and dill seed crops. Among the different honey bee species, *Apis florea* were the dominant forager.



### Synergism of different plant oils with different insecticides against pod borer, *Helicoverpa armigera* infesting chickpea

Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ ha	Application schedule	Waiting period/PHI (days)
				g.a.i./ ha	Quantity of formulation/ha	Con. (%)	Dilution in water (10 lit.)			
2020	Chick pea	<i>Helicoverpa armigera</i>	Chlorantraniliprole 18.5 SC + Neem oil	30 + 2500	162.5 ml + 2.5 lit	0.006 % + 0.5 %	3.25 ml + 50 ml	500 lit.	First spray when pest crosses the economic threshold level (0.75 larvae/plant before flowering and 0.5 larvae /plant after flowering) and second spray at 20 days interval after first spray	11

### Standardization of number of pheromone trap for fall army worm *Spodoptera frugiperda* (J. E. Smith) in maize

The farmers of South Saurashtra Agro-climatic Zone are advised to install 50 sex pheromone traps per hectare (20 sex pheromone traps per acre) at 10 days after germination and replace lure at 40 days for effective management of fall army worm in maize.



### Bio-efficacy of different biopesticides against fall army worm *Spodoptera frugiperda* (J. E. Smith) infesting maize

The farmers of South Saurashtra Agro-climatic Zone growing maize are advised to spray *Beauveria bassiana* 1.15 WP (1 x 10<sup>8</sup> cfu/g) 0.009 % (80 g/10 l of water) OR *Nomuraea rileyi* 1.15 WP

(1 x 10<sup>8</sup> cfu/g) 0.009 % (80 g/10 lit. of water) OR *Beauveria bassiana* 1.15 WP (1 x 10<sup>8</sup> cfu/g) 0.007 % (60 g/10 lit. of water) + SNPV 450 LE (10 ml/10 lit. of water), first spray at initiation of pest infestation and subsequent two sprays at 10 days interval for the effective and economical management of fall armyworm.





Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ ha	Application schedule
				g.a.i./ ha	Quantity of formulation /ha	Con. (%)	Dilution in water (10 lit.)		
2020	Maize	Fall army worm	<i>Beauveria bassiana</i> 1.15 WP (1 x 10 <sup>8</sup> cfu/g)	46	4.0 Kg.	0.009 %	80 g	500 lit.	First spray at initiation of pest infestation, subsequent second and third at 10 day interval
			<i>Nomuraea rileyi</i> 1.15 WP (1 x 10 <sup>8</sup> cfu/g)	46	4.0 Kg.	0.009 %	80 g		
			<i>Beauveria bassiana</i> 1.15 WP (1 x 10 <sup>8</sup> cfu/g) + <i>S/NPV</i>	35 + --	3.0 Kg. + 0.5 lit.	0.007 + 450	60 g + 10 ml		

**Bio-efficacy of different insecticides against fall army worm, *Spodoptera frugiperda* (J. E. Smith) infesting maize**

The farmers of South Saurashtra Agro-climatic Zone growing maize are advised to spray spinetoram 11.7 EC 0.012 % (10 ml/10 lit. of water)

OR emamectin benzoate 5 SG 0.0025 % (5 g/10 lit. of water) OR thiodicarb 75 WP 0.075 % (10 g/10 lit. of water), first at initiation of pest infestation and second after 15 days of first spray for effective and economical management of fall armyworm.



Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ha	Application schedule
				g.a.i./ ha	Quantity of formulation/ ha	Con. (%)	Dilution in water (10 lit.)		
2020	Maize	Fall army worm	Spinetoram 11.7 EC	59.00	0.5 lit.	0.012	10 ml	500 lit.	First spray at initiation of pest infestation and second at 15 day interval
			Emamectin benzoate 5 SG	13.00	0.250 lit.	0.0025	5 g		
			Thiodicarb 75 WP	375	0.5 lit.	0.075	10 g		



### Area wide integrated management of white grub in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut are advised to spray chlorpyrifos 20 EC 0.04 % (20 ml/10 l water) on surrounding host trees at onset of monsoon, seed treatment of chlorpyrifos 20 EC @ 25 ml/kg seed, soil

application of *Metarhizium anisopliae* OR *Beauveria bassiana* 1.15 WP @ 5 kg/ha (Min.  $1 \times 10^8$  cfu/g) + castor cake (300 kg/ha) before sowing and drenching of *M. anisopliae* or *B. bassiana* @ 5 kg ( $1 \times 10^8$  cfu/g) dissolved in 1000 l of water/ha in root zone of plant after 30 days of germination for the effective and economical management of white grub.



Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ha	Application schedule
				g.a.i./ha	Quantity of formulation /ha	Con. (%)	Dilution in water (10 lit.)		
2020	Groundnut	White grub	Chlorpyrifos 20 % EC (spray) + Chlorpyrifos 20 % EC (Seed treatment) + <i>Metarhizium anisopliae</i> 1.15 WP (Soil application and drenching)	200.0 + 600.0 + 57.50 + 57.50	1.0 lit.+ 3.0 lit+ 5.0 kg + 5.0 kg	0.04 + -- + 0.006+ 0.006	20 ml + NA + NA+ 50.0 g	1000 lit (Drenching)	Spraying on surrounding host trees at onset of monsoon, Seed treatment and soil application before sowing and drenching after 30 days of germination
			Chlorpyrifos 20 % EC (spray) + Chlorpyrifos 20 % EC (Seed treatment) + <i>Beauveria bassiana</i> 1.15 WP (Soil application and drenching)	200.0 + 600.0 + 57.50 + 57.50	1.0 lit.+ 3.0 lit+ 5.0 kg + 5.0 kg	0.04 + -- + 0.006+ 0.006	20 ml + NA + NA+ 50.0 g	1000 lit (Drenching)	

### Bio-efficacy of new insecticidal molecules against sucking pest of summer groundnut

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are advised to apply two sprays of imidacloprid 17.8 SL

0.005 % (2.8 ml/10 l of water) at 10 days interval starting from pest infestation for effective and economical management of thrips. Pre-harvest interval (PHI) of 40 days should be kept.

Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ha	Application schedule	Waiting Period/ PHI (days)
				g.a.i./ha	Quantity of formulation/ ha	Concentration (%)	Dilution in water (10 lit)			
2020	Groundnut	Thrips	Imidacloprid 17.8 SL	24.9	0.140 lit.	0.005	2.80 ml	500 lit.	First spray at initiation of pests and second at 10 days after first spray	40



### Bio-efficacy of biopesticides against sucking pest infesting groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut in *kharif* season are advised to apply two sprays of imidacloprid 17.8 SL 0.005 % (3.0 ml/10 l of water) at 10 days interval starting from pest infestation for effective and economical management of thrips. Pre-harvest interval (PHI) of 40 days should be kept.



Year	Crop	Pest	Pesticides with formulation	Dosage				Total* Quantity of Chemical suspension required/ha	Application schedule	Waiting Period/ PHI (days)	Remark (s)
				g.a.i./ ha	Quantity of formulation/ ha	Concentration (%)	Dilution in water (10 lit)				
2020	Groundnut	Thrips	Imidacloprid 17.8 SL	26.7	0.150 lit.	0.005	3 ml	500 lit.	Two sprays at 10 days interval starting from pest infestation	40	Registered under CIB approved list

### Management of white grub in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut in *kharif* season are advised to apply seed treatment with imidacloprid

600 FS @ 4 ml OR chlorpyrifos 20 EC @ 25 ml per kg of seeds for effective and economical management of white grub.

Year	Crop	Pest	Pesticides with formulation	Dosage				Total* Quantity of Chemical suspension required/ha	Application schedule
				g.a.i./ ha	Quantity of formulation/ ha	Concentration (%)	Dilution in water (10 lit)		
2020	Groundnut	Root feeders (White grub)	Chlorpyrifos 20 EC	--	3.000 lit.(ST)	0.5	25 ml/ kg seed	--	Seed treatment before sowing
			Imidacloprid 600 FS	--	0.480 lit.(ST)	0.192	4 ml/ kg seed	--	

### Testing of IPM modules with farmers practice against pest complex of pearl millet

The farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are advised to apply seed treatment of imidacloprid 600 FS @ 8.75 ml/kg at the time of sowing, removal of shoot fly

dead hearts, installation of fish meal traps @ 10/ha at 7 days after germination (fish meal to be replaced once in a week) and spraying of dimethoate 30 EC 0.03 % (10 ml/10 lit. of water) at 35 days after germination for effective and economical management of shoot fly.

Year	Crop	Pest	Pesticides with Formulation	Dosage				Total qty. of chemical suspension required /ha	Application schedule	Waiting period / PHI (days)	Remarks
				g.a.i./ha	Qty. of formulation/ ha	Concentration (%)	Dilution in water (10 lit.)				
2020	Pearl millet (bajra)	Shoot fly	Imidacloprid 600 FS	16.80	8.75 ml/kg seed	--	--	35 ml	Seed treatment at the time of sowing	Nil	Reg. in CIB
			Dimethoate 30 EC	150.00	0.5 L/ha	0.03	10 ml	500 ml	Single spray at 35 days after germination	Nil	Reg. In CIB

## Plant Pathology

### Biological control of root rot of coriander

The farmers of South Saurashtra Agro-climatic Zone growing coriander are advised to apply

talca based *Trichoderma harzianum* 1 % WP (2 x 10<sup>7</sup> cfu/g) @ 6.0 kg mixed in 500 kg of FYM per hectare at the time of sowing in furrows for effective and economical management of root rot.

Year	Crop	Disease	Pesticides/ Biopesticides formulation	Dosage			Quantity of water/ soil amendments require/ha	Application schedule
				g.a.i./ha	Quantity of formulation/ ha	Conc. (%)		
2020	Coriander	Root rot	<i>Trichoderma harzianum</i> 1.0 % WP	--	6.0 kg/ha	2 x 10 <sup>7</sup> cfu/g	500 kg FYM	Soil application in open furrow at the time of sowing

### Impact of Rhizobium isolates on groundnut under field condition

The farmers of South Saurashtra Agro-climatic Zone growing groundnut during *kharif* season are advised to give seed treatment of *Rhizobium leguminosarum* isolate-1 (10<sup>7</sup> cfu/ml) @ 10 ml/kg seeds along with soil application of recommended dose (RD) of P<sub>2</sub>O<sub>5</sub> (25 kg/ha) & K<sub>2</sub>O (50 kg/ha) and 75 % RD of N (9.4 kg/ha) at the time of sowing for obtaining higher pod yield and net return.

splits of 45 kg first at basal and remaining at 30, 60 and 90 days after sowing] for obtaining higher seed cotton yield and net return.



### Impact of phosphate solubilizing microorganism on cotton under field condition

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton are advised to give seed treatment of *Bacillus subtilis* JAU isolate-1 (10<sup>7</sup> cfu/ml) @ 10 ml/kg seeds along with soil application of recommended dose (RD) of N (240 kg/ha) [in equal

### Impact of Azotobacter isolates on cotton under field condition

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton are advised to give seed treatment of *Azotobacter chroococcum* isolate-1 10<sup>7</sup> cfu/ml @ 10 ml/kg seeds along with soil application of recommended dose (RD) of P<sub>2</sub>O<sub>5</sub> (50 kg/ha) and K<sub>2</sub>O (150 kg/ha) at the time of sowing in furrow and 75 % RD of N (180 kg/ha) [in equal four







four splits of 60 kg first at basal and remaining at 30, 60 and 90 days after sowing] and K<sub>2</sub>O (150 kg/ha) and 75 % RD of P<sub>2</sub>O<sub>5</sub> (37.5 kg/ha) at the time of sowing for obtaining higher seed cotton yield and net return.

**Impact of phosphate solubilizing microorganism on groundnut under field condition**



The farmers of South Saurashtra Agro-climatic Zone growing groundnut during *kharif* season are advised to give seed treatment of *Bacillus subtilis* JAU isolate-1 (10<sup>7</sup> cfu/ml) @ 10 ml/kg seeds along with soil application of recommended dose (RD) of N (12.50 kg/ha) and K<sub>2</sub>O (50.00 kg/ha) and 75% RD of P<sub>2</sub>O<sub>5</sub> (18.75 kg/ha) at the time of sowing for obtaining higher pod yield and net return.

**Biological control of root rot (*Macrophomina phaseolina*) of groundnut**

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advise to

10<sup>7</sup> cfu/g) @ 1.5 kg/ha + *Trichoderma viride* 1 % WP (2 x 10<sup>7</sup> cfu/g) @ 1.5 kg/ha OR *Trichoderma viride* 1% WP (2 x 10<sup>7</sup> cfu/g) @ 1.5 kg/ha + *Pseudomonas fluorescens* 1 % WP (1 x 10<sup>8</sup> cfu/g) @ 1.5 kg/ha mixed in 500 kg/ha well decomposed farm yard manure in furrow at the time of sowing, for effective and economical management of root rot of groundnut.



Year	Crop	Disease	Pesticides/ Biopesticides formulation	Dosage				Quantity of water/soil amendments required/ha	Application schedule
				a.i. (g/ha)	Quantity of formulation/ha	Conc. (%)	Quantity of formulation in 10 l of water (g or ml)		
2020	Groundnut	Root rot	<i>Trichoderma harzianum</i> 1 % WP + <i>Trichoderma viride</i> 1 % WP	--	1.5 kg/ha (1% WP) + 1.5 kg/ha (1% WP)	2 x 10 <sup>7</sup> cfu/g + 2 x 10 <sup>7</sup> cfu/g	--	500 kg FYM	Furrow application at the time of sowing
			<i>Trichoderma viride</i> 1 % WP + <i>Pseudomonas fluorescens</i> 1% WP	--	1.5 kg/ha (1% WP) + 1.5 kg/ha (1% WP)	2 x 10 <sup>7</sup> cfu/g + 1 x 10 <sup>8</sup> cfu/g	500 kg FYM	Furrow application at the time of sowing	



### Management of major foliar diseases of groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *khariif* groundnut are advised to apply seed treatment of mancozeb 75 % WP @ 3 g/kg seeds follow by two sprays of hexaconazole 5 %

SC, 0.005 % (10 ml/10 l of water) at 40 and 65 DAS for effective and economical management of early and late leaf spots (ELS & LLS) diseases of groundnut.

Year	Crop	Pest	Pesticides with formulation	Dosage				Total* Quantity of Chemical suspension required/ha	Application schedule	Waiting Period/PHI (days)
				g.a.i./ha	Quantity of formulation/ ha	Concentration (%)	Dilution in water (10 lit)			
2020	Groundnut	Foliar diseases of groundnut	Mancozeb 75 % WP	0	3 g/kg seed	--	--	0.36 kg	As a seed treatment	58
			Hexaconazole 5 % SC	25	0.500 lit.	0.005	10 ml	500 lit.	Foliar spray at 40 and 65 DAS	58

### Recommendation for Scientific Community

#### Entomology

#### Synergism of different plant oils with different insecticides against pod borer, *Helicoverpa armigera* infesting chickpea

Two sprays of flubendamide 48 SC 0.015 % + neem oil 0.5 % (3.20 + 50 ml/10 l of water) along with sticker (3 ml/10 l water), first spray when pest crosses the economic threshold level (0.75 larvae/plant before flowering and 0.5 larvae /plant after flowering) and second, at 20 days after first spray found effective against *Helicoverpa armigera* infesting chickpea.

#### Study on efficacy of different insecticides against white fly in papaya

Two sprays of acetamiprid 20 SP 0.006 % (3 g/10 l of water) OR thiamethoxam 25 WG 0.01 % (4 g/10 l of water), first at nymphs and adults infestation and second at 15 days after first spray found effective against whitefly (*Bemisia tabaci*) infesting papaya.

#### Bio-efficacy of new insecticidal molecules against sucking pest of summer groundnut

Two sprays of clothianidin 50 WDG 0.004 % (0.8 g/10 l of water) OR spinosad 45 SC 0.014 % (3.0 ml/10 l of water) OR dinotefuran 20 SG 0.006 % (3.0 g/10 l of water) at 10 days interval starting from pest infestation found effective against thrips in summer groundnut.

#### Bio-efficacy of biopesticides against sucking pest infesting groundnut

Two sprays of spinosad 45 SC 0.018 % (4 ml/10 l of water) at 10 days interval starting from pest infestation found effective against thrips in *khariif* groundnut.

#### Management of white grub in groundnut

Seed treatment with clothianidin 50 WDG 4 g per kg of seed found effective against white grub in *khariif* groundnut.

#### Phenology based application of selective insecticide/ biopesticide combinations for *Spodoptera exigua* and *Helicoverpa armigera* in chickpea

Spraying of profenophos 50 EC 0.13 % (26 ml/10 l water) followed by emamectin benzoate 5 SG 0.002 % (4 g/10 l water) 15 days after first spray was found effective against pod borer (*Helicoverpa armigera*) infesting chickpea.

#### Testing of IPM modules with farmers practice against pest complex of pearl millet

Seed treatment of imidacloprid 600 FS @ 8.75 ml/kg seeds + removal of shoot fly dead hearts + fish meal trap @ 10/ha at 7 days after germination (fish meal to be replaced once a week) + spraying of novaluron 10 EC 0.01 % (10 ml/10 l water) at 35 DAG recorded lowest stem borer per cent incidence of pearl millet.

### Testing the efficacy of different insecticides against shoot fly and stem borer in pearl millet

Seed treatment of clothianidin 50 WDG @ 7.5 g/kg seeds followed by spray of fipronil 5 SC 0.01 % (20 ml/10 l water) for shoot fly, while chlorantraniliprole 20 SC 0.006 % (3.0 ml/10 l water) for stem borer at 35 DAG were found effective in pearl millet.

### Evaluation of pre-harvest spraying of insecticides for management of pulse beetle (*Callosobruchus* sp.) in green gram

Green gram seeds can be protected up to two months from pulse beetle infestation during storage (seed purpose) by giving spray in the field either profenophos 50 EC 0.05 % (10 ml/10 l of water) or emamectin benzoate 5SG 0.0015 % (3.0 g/10 l of water) at 50 and 100 % pod maturity of green gram.

### Plant Pathology

### Development of technologies for the management of soil borne diseases of groundnut

Deep ploughing in summer with mould board plough + furrow application of *Trichoderma harzianum* 1 % WP ( $2 \times 10^6$  cfu/g) @ 4 kg/ha enriched with 250 kg FYM/ha at the time of sowing + seed treatment with tebuconazole 2 DS @ 1.5 g/kg of seeds followed by seed treatment with PGPR ( $1 \times 10^7$  cfu/g) @ 5 ml/kg seeds + line application of *T. harzianum* 1 % WP @ 4 kg/ha enriched with 250 kg FYM/ha at 35 and 70 DAS near the base of plant found effective against collar rot and stem rot diseases in groundnut.

### Management of major foliar diseases of groundnut

Seed treatment of tebuconazole 2 DS @ 1.5 g/kg seeds with two spray of tebuconazole 50 % + trifloxystrobin 25 % WG @ 0.035 % (13.2 g/10 l of water) at 40 and 65 DAS found effective against foliar diseases (Early Leaf Spot and Late Leaf Spot) in *kharif* groundnut.

### Evaluation of different IPDM modules for management of major insect-pest and diseases in groundnut

Seed treatment with *Trichoderma harzianum*

1 % WP @ 4 g/kg seed + need based spray of imidacloprid 17.8 SL 0.005 % (3 ml/10 l water) for sucking pest + need based spray of novaluron 10 EC 0.010 % (10 ml/10 l water) for defoliators at 50-70 DAS + two sprays of tebuconazole 25.9 EC 0.0259 % (15 ml/10 l water) at 50 and 70 DAS found effective against early leaf spot and late leaf spot diseases and leaf damage caused by defoliators (*Helicoverpa* & *Spodoptera*) of groundnut.

### 4.6 Horticulture and Agro 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**

Sr. No.	Planting Material	Production (Nos.)
1	Fruit crop graft	7709
2	Fruit crops saplings	86107
3	Seedlings	25448
4	Ornamentals & Medicinal plants	55169
	<b>Total</b>	<b>174443</b>

### Recommendation for Farmers

#### Effect of fertilizers and paclobutrazol on bearing behavior of rejuvenated mango trees (*Mangifera indica* L.) cv. Kesar

Farmers of South Saurashtra Agro-Climatic Zone having rejuvenated Kesar mango orchard are advised to apply paclobutrazol @ 7.5 g.a.i. per tree in the month of mid of July in soil and apply 150 per cent RDF in two split from 4<sup>th</sup> year after rejuvenation (i.e. 150 kg FYM + 562.5:240:562.5 NPK g/tree as basal and 562.5:0:562.5 NPK g/tree at February) for getting higher yield and net return.



#### Integrated nutrient management in pomegranate (*Punica granatum* L.) cv. Bhagwa

The farmers of South Saurashtra Agro-climatic Zone growing pomegranate cv. *Bhagwa* are advised to apply ½ dose of 75 % RDNK i.e. 188 g/plant Nitrogen and Potash (K<sub>2</sub>O) with full dose of Phosphorus (P<sub>2</sub>O<sub>5</sub>) i.e. 250 g/plant as basal dose (in the form of DAP- 543 g, Urea-195 g, Muriate of Potash - 313 g/plant), *Azotobacter* and *Potassium Solubilizing*

*bacteria* (KSB) each @ 5.0 ml/plant in the month of October. Apply remaining ½ doses of Nitrogen and Potash (408 g urea and MOP 313 g /plant) in the month of February for getting higher yield and net return.

#### Effect of chemical fertilizer application in split on coconut cv. TxD (Mahuva)

The farmers of South Saurashtra Agro Climatic Zone growing coconut cv. T×D (Mahuva) are advised to apply FYM 50 kg/palm/year with 125 % RDF NPK @1875, 938, 1875 g/palm/year in four equal split [June-Sept-Dec.-March] for securing higher nut yield and net return.

#### Recommendations for Scientific Community

#### Effect of foliar spray of chemicals to induce flowering and fruiting on rejuvenated mango trees cv. Kesar

The scientific community is informed to spray cycocel (CCC) @ 1000 ppm (1 ml in one liter of water) during October and second spray after one month of first spray in rejuvenated Kesar mango orchard for obtaining higher yield and net return.

#### 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.





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**

Categ ory	Name of Equipment / Machine	No. of Equipment / Machine Tested
A	Land development, tillage & seedbed preparation equipment	52
B	Sowing and planting equipment	21

C	Intercultivation equipment	2
D	Plant protection equipment	5
E	Harvesting and threshing equipment	12
F	Equipment for residue management	1
G	Post-harvest and agro processing equipment	5
<b>Total</b>		<b>98</b>

### Recommendation for Farmers

#### Design and development of a manually operated seed drill for small seeds

Farmers and manufacturers are recommended to adopt JAU developed manually operated drum seeder for sowing of small seeds (like sesame, pearl millet *etc*). The drum seeder sows 45 cm spaced two rows at a time with the effective field capacity of 0.18 ha/h. The drum seeder is found useful for precision sowing of small seeds.



#### Development of device for dung collection from cattle shed

Animal rearer's and Gaushala owners are recommended to use 'Mini Tractor Operated Cattle Dung Collecting Device' developed by Junagadh Agricultural University. It reduces the labour requirement by 87 % with collection efficiency of about 91 % and it is also beneficial from hygiene point of view for labourers and animals.





### Design and development of on farm solar assisted dryer for drying of groundnut pods for longer storage

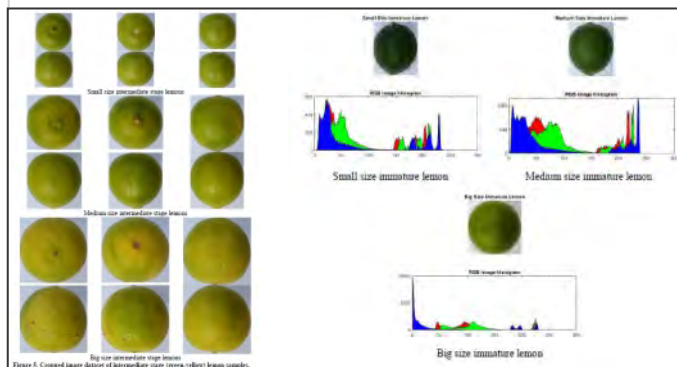
The farmers growing groundnuts and processors drying groundnut pods are recommended to use the solar assisted dryer developed by Junagadh Agricultural University. Use of solar assisted dryer for drying of threshed groundnut pods to reduce moisture content from 11 to 13.9 % (wb) to safer storage moisture content of 6 to 7 % (wb) using dryer condition of about 50 °C air temperature and about 0.099 m<sup>3</sup>/s air flow in 7 to 8 hours (i.e. 1 day). Use of solar assisted dryer can reduce drying time (7 h) to seven times less than sun drying (50 h) and reduces the post-harvest losses of groundnut pods in drying, handling, storage as compared to sun drying.

Details of solar assisted dryer

- Capacity of dryer: 125kg per batch (Groundnut pods)
- Drying trays : 12 trays arranged in 6 tiers (10±0.50 kg per tray)
- Solar collectors: 8 Nos. (1 m x 2 m)
- Drying air temperature : about 50 °C
- Air flow rate: 1.0 m/s
- Blower capacity: 1.5 hp, 28 m<sup>3</sup>/min
- Maximum increment in drying temperature: 26.9 °C to 39.8 °C
- Drying time: 7 to 8 hours

### Lemon grading simulation based on image processing technique

Fruit grading machine manufacturers are recommended to adopt the image processing technique-based simulation developed by Junagadh Agricultural University, Junagadh for grading of lime (kagji) based on their size and colour. The limes can be graded in 3 x 3 different categories according to their size (small, medium and big) x maturity (immature, intermediate and mature) by applying the size and colour features of lime obtained through this simulation.





### Forced air curing of onion

The farmers curing traditionally and storing red onion are recommended to use forced air curing at about 40 °C temperature with air flow rate about 0.24 m<sup>3</sup>/s and without foliage onion bulb for obtaining higher quantity of marketable onion after six months of storage.

### Development of high protein extruded product using defatted peanut flour

Snacks manufacturing units are recommended to adopt a process technology developed by Junagadh Agricultural University for the preparation of extruded product by using a proportion of defatted peanut flour and corn flour as 26:74 (w/w) with the help of twin screw extruder machine to increase the protein content in Ready-to-Eat extruded products. The suggested optimum conditions to prepare extruded product using defatted peanut flour are feed moisture content: 13 % (wb), die head temperature: 135 °C, feed temperature: 60 °C, barrel temperature: 100 °C and screw speed: 250 rpm. This process can prepare the extruded product of increased protein content with desired product characteristics.



### Value addition in sesame: Standardization of technology for preparation of Sani - Jaggery based crushed sesame

Sesame producers and processors are recommended to adopt the process technology developed by Junagadh Agricultural University to

prepare *sani*. The *Sani* should be prepared from black raw sesame, added with 60 % jaggery as well as 10 % shredded cashew nut and almond (1:1). *Sani* prepared through this method and packed in PET (Polyethylene Terephthalate) container remains safe up to 25 days of storage. This method can prepare the good quality *sani* with benefit cost ratio (BCR) of 1.51.

### Preparation and storage studies of Jamun Juice

Farmers/ Food processors are advised to heat the Jamun juice at 67 °C temperature for 13 minutes and add 0.03 % (w/w) sodium benzoate at little warm state to preserve its nutrients. The Jamun juice, thus, prepared packed in 1 litre PET bottle, can safely be stored up to 30 days in the refrigerator (7 ± 2 °C).



### Recommendation for Scientific Community

#### Evaluation of hydraulic performance of oozing pipe irrigation

The irrigation applications through porous pipe system gives very poor uniformity coefficient of 6.65 % in case of 60 m lateral length at 100 cm input head to 47 % in case of 30 m lateral length at 200 cm input head, which should be more than 90 %. The uniformity in the wetting bulb size along the length of lateral also varies greatly

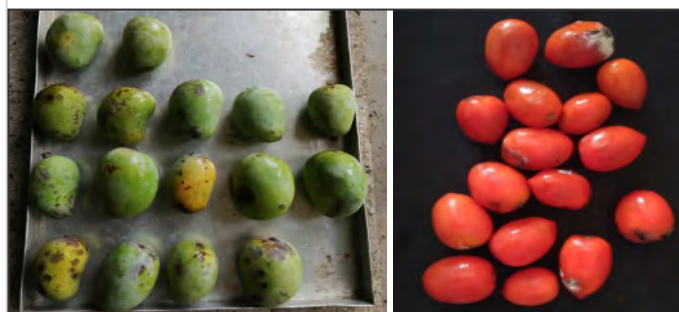
#### Effect of ozonization against the microorganisms of fruits and vegetable

Scientific communities are advised to store mangoes & limes after applying a treatment of ozone 3 minutes (flow rate : 400 mg / hour) packed in 25 µ plastic bag (1 pinpoint hole per 2 x 2 square inch area of plastic bag) and kept at 10 °C temperature remain safe against the microbial load up to 50 days & 120 days respectively.





Whereas exporters are recommended to store tomatoes up to 21 days by applying a treatment of ozone 3 minutes (flow rate: 400 mg / hour) packed in 50  $\mu$  plastic bag (1 pinpoint hole per 2 x 2 square inch area of plastic bag) and kept at 10 °C temperature remain safe against the microbial load.



#### 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.

##### Recommendation for Farmers

##### Effect of integrated nutrient management on growth and yield of chickpea under North Saurashtra region

The farmers of North Saurashtra Agro-climatic Zone growing chickpea (GJG-3) in *rabi* season are advised to apply 50% of RDF (N:P:K 10:20:0 kg) + 10 kg K<sub>2</sub>O + 5 kg bentonite + 500 kg vermicompost per hectare under three irrigations for obtaining higher yield and net returns due to enhancement in growth parameters like increase in number of pods and pod weight.



##### Recommendation for Scientific Community Phytochemical, antioxidant and antidiabetic characterizations of custard apple (*Annona squamosa* L.) genotypes

It is informed to the scientific community that, out of 30 custard apple genotypes tested, fruit pulp of genotypes DS-1, Aml-10 and Aml-6 recorded higher  $\alpha$  amylase inhibition (as antidiabetic potential) and % DPPH (1,1-Diphenyl-2-picrylhydrazyl) free radical scavenging (as antioxidant activity). The ascorbic acids and phenols contributed positively for both  $\alpha$  amylase inhibition and % DPPH free radical



scavenging activities in fruit pulp of custard apple. Phytochemicals analysis illustrated that terpenoids and flavonoids present in fruit pulp are positively correlated with antioxidant activity whereas alkaloids showed significantly positive correlation with antidiabetic potential.

### Qualitative and nutritional evaluation of promising genotypes of groundnut

The scientific community involved in groundnut improvement is recommended to use below mentioned groundnut genotypes for the qualitative and nutritional improvement of groundnut crop.

Sr.	Name of genotype	Name of quality/ nutritional	Range of quality/ nutritional
1	GG-16, KDG-123, GG-4, RG-578	Total soluble sugar	24.40 to 24.68 %
2	TG-51, ICGV-00440, JL-501	Total carbohydrate	10.56 to 10.75 %
3	RG-510	True protein	23.22 %
4	TLG-45, JSSP-35, ICGV-86156	Total oil	50.55 to 51.21 %
5	JL-501	Iron	95.85 ppm
6	GJG-9, ICGV-02266, TPG-41, GJG-17,	Calcium	1366.29 to 1403.67 ppm
7	ICGV-15055	Oleic acid	80.21, % of total fatty acid
8	ICGV-15035, ICGV-15033, ICGV-	O/L ratio	22.88 to 23.88

### 4.9 Veterinary Science & Animal Husbandry

Cattle Breeding Farm, Junagadh Agricultural University is the largest and oldest farm and is the only organized research station where 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 this station has a 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.





**Table: 4.9.1 Distribution of Semen doses from CBF**

Sr. No.	Particular	Gir Bulls	Jaffrabadi Bulls
1.	Frozen semen doses available in stock from last year (Nos.)	170531	90593
2.	Frozen Semen doses Produced (Nos.)	21930	31920
3.	Frozen Semen doses used for AI in Field (Nos.)	1995	2965
4	Frozen Semen doses used for AI on Farm (Nos.)	655	200
5.	Frozen Semen doses sold to AI Workers (Nos.)	964	6390
6.	Frozen semen doses in stock (Nos.)	188847	112958
7.	Animals distributed to Grampanchayat, Gaushala, other Institute etc. (Nos.)	33	44

**Table 4.9.2 Total number of cases treated at TVCC**

Types of cases	Cattle	Buffalo	Equine	Canine	Others	Total
Medicine	1182	1207	312	2233	624	5558
Gynecology	352	401	54	97	61	965
Surgery	868	637	370	800	288	2963
<b>Total</b>	<b>2402</b>	<b>2245</b>	<b>736</b>	<b>3130</b>	<b>973</b>	<b>9486</b>

**Table 4.9.3 Total no. of cases treated through Ambulatory Clinics and Clinical Camps**

Type of case	Ambulatory Clinic	Clinical Camps
Medicine	686	770
Gynecology	116	168
Surgery	145	142
Deworming	J	100390
<b>Total</b>	<b>947</b>	<b>101470</b>

### Recommendations for Dairy Farmers

#### Incorporation of *Cucurbita pepo* (pumpkin) pulp for the preparation of value added flavoured buffalo milk

The dairy entrepreneurs are informed to incorporate 15 % *Cucurbita pepo* (pumpkin) pulp and 10 % ground sugar for the preparation of good and acceptable quality Pumpkin flavoured buffalo milk. The shelf life of good quality pumpkin flavoured buffalo milk can be maintained for at least 6 months at room temperature subjecting to “in bottle heat treatment” at  $110 \pm 2$  °C for 15 minutes after filling into cleaned and sterilized glass bottle.



### Recommendation for Scientific Community

#### Evaluation of an immunomodulatory effect of *Abrus precatorius* L. in mice

Oral administration of hydro-alcoholic extract of *Abrus precatorius* L. (Chanothi) leaves at

the dose rate 200 mg/kg body weight/day for 14 days, revealed immunostimulant effect against Cyclophosphamide induced immunosuppression in mice.



### Studies on prevalence, haemato-biochemical & diagnostic aspects of fasciolosis by coprological examination in cattle & buffalo of Junagadh district

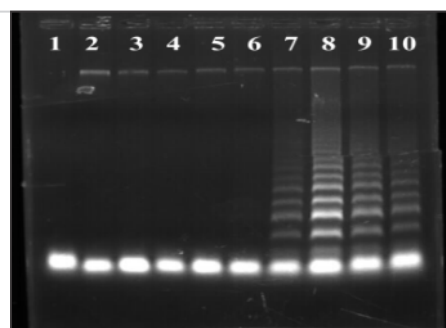
Overall prevalence of *Fasciola* infection is very less in bovines (1.88 %) in and around Junagadh.





### Optimization of Loop Mediated Isothermal Amplification (LAMP) test for diagnosis of *Trypanosoma evansi* infection in animals

The following designed and optimized primers targeting RoTat1.2 gene are equally specific and sensitive for detection of *Trypanosoma evansi* infection in animals through LAMP assay compared to PCR.



Primer ID	Types	Sequence (5'-3')
Tf3 (Forward)	Outer primer	GCACAAATGCCGACGGTA
Tb3 (Reverse)		GTCGTTGCCGGTTATTGCT
FIP1 (Forward)	Internal primer	AGGTAGCTGTCTCCTGGGGCCGAAATCGACGCGCTAGG
BIP1 (Reverse)		GGCGACATAAGCGCCGATGGGCAGGTGTTGCTTCCTACA
LF1 (Forward)	Loop primer	GTCATAGTTGGCTTCGCCG
LB1 (Reverse)		CACAAAACATAACAGCCGTTGCAG

### Receiver operating characteristic (ROC) analysis of milk components for sub-clinical mastitis in Gir cows.

In Gir cows, milk components particularly milk SNF, protein, lactose and ash decrease and Somatic Cell Counts increases in udder infection during early and mid-lactation. Healthy udder quarters could be differentiated from severely infected quarters by milk lactose threshold with moderate accuracy during early and mid-lactation.

#### 4.10 Fisheries Science

Fisheries science includes research in the areas of Fisheries Resource Management, Harvest and Post-

Harvest Technology of fishes, Aquaculture, Fishery Hydrography and Fishery Engineering. College of Fisheries Science, Veraval has produced 11,000 fingerlings and ornamental fish seeds of various species like *Guppy*, *White molly*, *Black Molly*, *Orange molly*, *Sword tail*, *Platy* and *Gaurami*. Fisheries Research Station, Sikka has produced 147.22 lakh pearl oyster larvae. The research station has also successfully breed 6 opisthobranches species in captive condition i.e, *Hypselodoris infucata*, *zorunna funebris*, *bornella stellifera*, *phestilla lugubris*, *doriopsilla miniata* and *peltodoris murrea* were also breed in captive condition.





#### 4.11 Social Science

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

Agricultural economists worked on different research projects *viz.* Farm cost studies of important crops in Gujarat state; Economics of selected *kharif* vegetable crops grown in Saurashtra Region of Gujarat; Price forecasting for selected crops; Spatial and temporal integration analysis and price discovery mechanism of major potato wholesale markets in Gujarat; Mapping and valuation of economic, societal and environmental benefits of conserving Gir forest ecosystem and scheme for creating a permanent machinery for studying the cost of cultivation/production of principal crops in Gujarat state. Yield, production and price forecast of different crops *viz.* groundnut, cotton, castor, cumin, coconut *etc.* were analyzed for suggestions to farmers.

##### Recommendation for Scientific Community

#### A comparative study on groundnut yield forecasting models for Junagadh district

The groundnut productivity can be forecasted at the 10<sup>th</sup> week after sowing and use multiple linear regression models having generated weather variables with correlation coefficient between groundnut productivity and weather variables as weight and original weather variables using week wise approach with higher predictability and lower deviations between forecasted and observed

productivity.

#### Financial inclusion of farmers in Saurashtra region

To promote financial inclusion in Saurashtra region, the farmers with land holding up to 4 ha need to be provided with lesser used financial services *viz.* medium and long term credit, personal health insurance and pension within 14 km radius of their households.

#### Assessment of hygienic milk production practices adapted by dairy farmers for quality milk production

To improve the adoption of clean milk production practices among dairy farmers, targeted training programmes need to be organized giving priority to the farmers' age, education level, extension participation and source of information.

#### Training needs of rural women in home science related activities

It is recommended to extension personnel of the Amreli district that trainings of bakery, papad and vadi making, jam making, value-added products of pearl millets as well as awareness about the government schemes for girl child is most needed for women empowerment. Extension personnel should prefer demonstrations, field visits and study tours for such trainings.

#### 4.12 Human Resource Development

During the year 2019-20, under HRD component of the University, as a part of capacity building for JAU scientists, 126 scientists/teachers



were deputed to attend winter & summer school Short/Refresher Course, training; 217 attended seminar, symposium, conference, convention; 139 attended the workshops, group/annual/QRT meeting of their respective projects and 157 scientists/ teachers were deputed to attend AICRP monitoring, visit of other stations etc. at national as well as state level. The University has also organized seven national/state

level programs like winter/ summer school, seminar, symposium. Training *etc.*

#### 4.13 Others

#### Front Line Demonstration (FLD) conducted on farmers' field

Crop scientists have successfully organized front line demonstration on farmers' fields organized by research stations of JAU.

**Table 4.13.1 Summary of information of improved varieties**

Sr. No.	Crop	Improved variety	No. of FLDs	Total area under FLD (ha)	Yield in IP (q/ha)	Yield in FP (q/ha)	Increase in yield (%)
1	Cotton	Cot. Hy-8 BGII	2	0.8	21.35	20.45	4.40
2	Groundnut (Summer)	GJG 31	10	4.0	23.05	18.90	22.01
3	Groundnut (Kharif)	GJG 22	18	7.20	21.50	16.25	13.23
4		GJG 32	3	1.20	23.50	20.00	17.50
5		GJG HPS 2	10	4.00	25.50	21.00	21.43
6		GG 9	13	5.2	21.93	18.82	16.52
7	Castor	GCH 9	31	12.40	38.32	31.97	20.81
8	Pearl millet (Summer)	GHB 538	30	12	47.14	44.68	5.51
9		GHB 732	20	08	47.76	45.33	5.37
10	Pearl millet (Kharif)	GHB 732	25	10	17.44	16.47	5.89
11	Wheat	GW 451	25	10	63.25	57.25	11.25
12		Q	50	20	54.10	47.96	12.81
13	Chickpea	Guj Chickpea 3	5	2.00	14.65	13.11	11.71
14	Sesame	G.Til 4	4	3.2	4.36	3.83	13.84
15	Coriander	Guj. Co.-2	19	0.8	12.34	10.78	14.47
16		Guj. Co.-3	4	0.4	16.50	15.43	6.93
17	Cumin	Guj. Cumin-4	14	0.8	10.21	8.73	16.95
18	Fenugreek	Guj. Fenugreek-2	1	0.4	16.00	13.90	15.10
19	Garlic	Guj. Garlic-5	5	0.4	67.92	60.92	11.51

Table 4.13.2 Summary of information of improved technology

Sr. No.	Crop / other	Improved technology	No. of FLDs	Total area under FLD (ha)	Yield in IP (q/ha)	Yield in FP (q/ha)	Increase in yield (%)
1	Cotton	Integrated Crop Management	53	30	21.60	20.03	7.83
2		IRM, PBW	50	20	23.11	19.12	21.52
3		High density planting	02	0.8	21.42	20.75	3.23
4		De-topping	01	1.4	22.32	20.25	10.22
5		In-situ moisture conservation	05	2.5	18.12	16.04	13.00
6		Foliar spray	06	2.4	16.06	15.42	4.15
7		Integrated Nutrient Mgmt.	03	1.2	19.87	18.23	9.00
8		Integrated Pest Management	15	6.0	19.92	18.52	7.56
9		Inter cropping	21	10	23.97	19.66	9.00
10	Cotton + Pulses	Inter cropping	04	3.8	27.28	21.30	28.08
11	Groundnut	Integrated Pest- Disease Mgmt.	15	6.0	21.32	20.11	6.02
12		In-situ moisture conservation	06	5.7	22.94	21.37	7.33
13		Foliar spray	06	2.4	22.45	22.00	2.04
14		Integrated Nutrient Mgmt.	03	1.2	21.25	19.85	7.05
15	Groundnut (Summer)	Whole package	10	4	23.05	18.90	22.01
16	Groundnut ( <i>Kharif</i> )	Whole package	38	15.20	22.61	19.27	17.44
17	Groundnut + Castor	Inter cropping	03	1.1	28.81	22.07	30.56
18	G'nut + Pigeon pea	Inter cropping	01	2.4	30.90	23.45	31.77
19	Castor ( <i>Kharif</i> )	Whole package	31	12.40	38.32	31.97	19.88
20		Inter cropping	21	8.40	51.91	21.76	140.23
21	Wheat	Integrated Nutrient Mgmt.	5	2.00	33.75	30.18	11.83



22	Cumin	Integrated Nutrient Mgmt.	5	2.00	7.49	6.67	12.20
23	Sesame	Whole package	4	3.2	2.71	2.25	20.44
24		Intercropping	3	2.4	8.65	6.43	34.52
25		Fertilizer Mgmt.	5	4.0	5.44	4.69	15.82
26		Plant protection	4	3.2	2.96	2.92	1.37
27	Pigeon pea	Seed treatment + Pesticides for pod borer control	10	7	16.89	14.47	17.00
28	Chick pea	Seed treatment + drenching + Pest control	10	10	25.25	21.01	20.00

**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-1) equivalent yield

**Table 4.13.3 Summary of information of improved technology**

Sr. No.	Improved Machine	No. of FLD	Total Area	No. of Farmers
1	Cotton Shredder	5	2.63 ha	20
2	Mulch Laying Machine	10	6.50 ha	40
3	Drip line Installer and Retriever	4	3.38 ha	25

**Table 4.13.4 New research programs sanctioned**

SN	Agency	No. of Research Programs	Amount (Rs. in Lakh)
1	ICAR	1	20.240
2	Govt. of India/ Govt. of Gujarat	-	-
3	RKVY	5	733.230
4	Other Agencies	17	134.533
	<b>Total</b>	<b>23</b>	<b>888.003</b>

