



# RESEARCH

## Chapter - IV



#### 4.1 Agricultural Research Council

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

section 17(5). Dr. V. P. Chovatia monitored and guided the research activities during the reporting period. 15<sup>th</sup> Research Council meeting was organized on January 15, 2018 for approval of new research programs and research activities during the year.

**Table 4.1: Members of 14<sup>th</sup> Agricultural Research Council**

No.	Name	Designation
1	Dr. A. R. Pathak	Vice Chancellor (Chairman)
2	Dr. V. P. Chovatia	Director of Research & Dean PG Studies (Secretary)
3	Dr. B. M. Modi	Director of Agriculture, Government of Gujarat, Gandhinagar
4	Dr. P. M. Vaghasia	Director of Horticulture, Government of Gujarat, Gandhinagar
5	Dr. A. J. Kachhia Patel	Director of Animal Husbandry, Govt. of Gujarat, Gandhinagar
6	Dr. A. M. Parakhia	Director of Extension Education
7	Dr. I. U. Dhruj	Associate Director of Research
8	Dr. Promod Mohnot	Associate Director of Research
9	Dr. G.S. Sutaria	Associate Director of Research, JAU, Targhadia
10	Dr. V. P. Chovatia	Dean, Agriculture Faculty
11	Dr. N. K. Gontia	Dean, Agricultural Engineering Faculty
12	Dr. A. Y. Desai	Dean, Fisheries Science Faculty
13	Dr. P. H. Tank	Dean, Veterinary Science & Animal Husbandry Faculty
14	Dr. K. A. Khunt	Dean, Post Graduate Institute of Agribusiness Management
15	Dr. M. A. Vaddoria	Research Scientist and Convener, Crop Improvement AGRESCO Subcommittee
16	Dr. K. B. Polara	Prof. and Convener, Crop Production AGRESCO Subcommittee
17	Dr. V. V. Rajani	Research Scientist and Convener, Plant Protection AGRESCO Subcommittee
18	Dr. R. S. Chovatia	Professor & Head and Convener, Horticulture & Agro Forestry AGRESCO Subcommittee
19	Dr. R. Yadav	Professor & Head and Convener, Agricultural Engineering AGRESCO Subcommittee
20	Dr. V. J. Bhatia	Professor & Head and Convener, Basic Science AGRESCO Subcommittee
21	Dr. S. M. Upadhyay	Professor & Head and Convener, Social Science AGRESCO Subcommittee
22	Dr. K. S. Murty	Professor & Head and Convener, Animal Science & Fisheries AGRESCO Subcommittee
23	Dr. K. L. Dobaria	Research Scientist (Groundnut)
24	Dr. B. A. Golakia	Professor & Head (Biotechnology)

No.	Name	Designation
25	Dr. B. K. Sagarka	Professor & Head (Agronomy)
26	Dr. P. M. Chauhan	Professor & Head (RERE)
27	Dr. M. R. Gadaria	Research Scientist, Bull Mother Farm, JAU, Amreli
28	Dr. S. I. Yusufzai	Associate Research Scientist, Fisheries College, JAU, Veraval
29	Dr. V. K. Poshiya	Retired Research Scientist (Plant Breeding)
30	Dr. H. J. Vyas	Retired Professor (Entomology)
31	Shri Sanjaybhai Ratibhai Vagadia	Progressive Farmer, 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 scheme were solved satisfactorily by discussion between scientists and the Director of Research in two meetings held during the month of December-2017 and February-2018 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) 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	Str. of research in millet	1986	MPMRS, Jamnagar
2	12006-00	Str. of research in sorghum	1981	CRS, Kukada
3	12007-00	Str. of research in pulses	1989	PRS, Junagadh
4	12008-00	Str. of research in oilseed (G'nut)	1986	MORS, JND&ORS Manavadar
5	12009-00	Centre of excellence for cotton res.	1986	CRS, Junagadh and ARS, Amreli & Ratia
6	12013-00	Str. of scheme of vegetable res. at Junagadh	1995	VRS, Junagadh
7	12027-00	Scheme for mgmt. of salt affected soil & poor quality of under-ground water	1988	Dept. of Ag. Chem. & Soil Sci., Junagadh
8	12044-01	Research in bio-technology	1995	Dept. of Biochem., Junagadh
9	12078-00	Str. of research in dry-farming	1979	DFRS, Targhadia & Ratia
10	12092-00	Str. of tissue culture res. & devp. at campus	1990	Dept. of GPB, Junagadh
11	12094-00	Res. for integrated pest mgmt. in fruit crops	1997	Dept. of Entomology, Junagadh
12	12095-00	Str. of horti. res. & devp. activities	1997	Dept. of Horticulture, Junagadh
13	12096-00	Res. on micro irri. system in Saurashtra region	1997	Dept. of Agronomy, Junagadh
14	12131-00	Res. 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 & College of Fish. Sci., Veralal
16	12712-5B	Campus development program (on campus)	2004	DR, Junagadh
17	12903-00	Organic farming cell at Junagadh	2000	Dept. of Agronomy, Junagadh
18	12905-00	Research on watershed management	2000	MDFRS, Targhadia; GRS, Dhari & Dept. of SWCE, CAET, Junagadh
19	12907-00	Str. of agro-meteorology at JAU	2000	Dept. of Agronomy, Junagadh
20	12930-00	New sub-center for res. on cumin	1998	Agriculture School, Halvad
21	12931-00	New research centre on onion crop	2003	VRS, JND&FRS, Mahuva
22	12573-00	Research on tillage technology	2006	Dept. of Agronomy, Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
23	12574-00	Res. on rejuvenation of degraded coastal agro-eco systems of Saurashtra	2006	RTTC, Junagadh
24	12575-00	Str. research in sesamum	2006	Agril. Research Station, Amreli
25	12101-00	Centre of excellence on soil and water mgmt.	2006	RTTC, MDFRS, Targhadia; ARS, Mahuva &FRS, Mangrol
26	12576-00	Res. on PHT of important crops of Saurashtra	2006	Dept. of PFE, CAET, Junagadh
27	12582-00	Str. of res. on genetically modified cotton	2009	CRS, Junagadh
28	12583-00	Str. of wheat research	2009	WRS, Junagadh
29	12584-00	Str. research on castor	2009	MORS, Junagadh
30	12585-00	Str. research in sugarcane	2009	MSRS, Kodinar
31	12586-00	Str. of res. n plantation and fruit crops	2009	ARS (FC), Mahuva
32	12587-00	Conservation of plant biodiversity	2009	Dept. of GPB, Junagadh
33	12588-00	Development of arid and semi-arid fruit crops	2009	Dept. of Horti.,Junagadh
34	12590-00	Bt cotton res.Centre at Surendranagar district	2011	CRS,Kukada
35	12014-00	Establishment of spices res. Centre at Junagadh	2011	VRS, Junagadh
36	12015-00	Establishment of bio-fertilizer unit at Junagadh	2011	Dept. of Plant Patho.,Junagadh
37	12018-00	Research Centre on onion at Talaja	2011	ARS, Talaja
38	12019-00	Str. of dry farming research	2012	DFRS, JamKhambhaliya
39	12020-00	Str. of dry farming research at Vallbhipur	2012	DFRS, Vallbhipur
40	12021-00	Establishment of mango res. project at Talala	2012	Dept. of Horti.,Junagadh
41	12022-00	Quality seed prod.& distribution(Mega seed)	2012	Dept. of SST,Junagadh
42	12023-00	Micronutrients and sulphur res. in soils and plants in Saurashtra region	2012	Dept. of Ag. Chem.&Soil Sci. Junagadh
43	12024-00	Centre of Remote Sensing and Geoinfo. in agri.	2012	Dept. of SWCE, Junagadh
44	12025-00	Recycling of organic waste for sustainable soil productivity under dry land agri.	2012	MDFRS, Targahdia



Sr. No.	Budget Head	Scheme Name	Sanction Year	Location
45	12026-00	Research on forage crop production	2012	GRS, Dhari
46	12028-00	Aflatoxin and its mgmt. in g'nut in Saurashtra region of Gujarat	2013	MORS, Junagadh
47	12029-00	Molecular mapping of important traits and their transfer through MAS in g'nut and cotton	2013	Dept. of Biochem., Junagadh
48	12030-00	Effect of climate change on fruit crops of Saurashtra region	2013	Dept. of Horti., Junagadh
49	12303-05	Estab. of Gir Cattle & Jaffrabadi buffaloes	1996	CBF, Junagadh
50	12953-00	Str. of livestock & veterinary component	2002	CBF, Junagadh
51	12303-14	Integrated farming system	2009	CBF, Junagadh
52	12303-15	Estab. of bull mother farm of Gir cattle & Jaffrabadi buffaloes	2011	CBF, Junagadh
53	12950-00	Establishment and devp. of res. in fisheries	2000	FRS, Okha
54	12577-00	Value added products from fish / shelifish	2006	CoF, Veraval
55	12578-00	Establishment of inland fishery research centre	2006	IFRS, Junagadh
56	12579-00	Establishment of pearl oyster hatchery	2009	FRS, 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	FRS, Okha
58	12016-00	Estab. of aqua-based res. and training centre in coastal Saurashtra at Mahuva	2011	ARS (FC), Mahuva
59	12031-00	Crop improvement in papaya at Junagadh	2014	Dept. of Horti., Junagadh
60	12032-00	Integrated pest mgmt. in seed spices	2014	Dept. of Ento., Junagadh
61	12033-00	Evaluation of pharmacological activity of indigenous medi. plants of Saurashtra region	2014	CoVSAH, Junagadh
62	12034-00	Identifi.& docum. of marine fish biodiversity using mitochondrial DNA bar coding	2014	CoF, Veraval

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

Sr. No.	Budget Head	Name of Program	Sanction Year	Location
1	3226	Scheme for design of experiment	1980	Dept. of Agril. Statistics, Junagadh
2	5002	Scheme for research in bajra	1985	MPMRS, Jamnagar & ARS, Talaja
3	5004	Scheme for research in wheat	1995	WRS, Junagadh and FRS, Mangrol
4	5006	Scheme for research in sorghum	2011	CRS, Kukada
5	5007	Research in pulses	1975	PRS Junagadh
6	5008	Scheme for oilseed research	1962	MORS, Junagadh
			1973	ARS, Amreli
			1979	MSRS, Kodinar & ORS, Manavdar
			1985	MPMRS, Jamnagar
7	5009	Str. of res. in cotton investigation of fiber crops other than cotton, devp. of remie fiber.	1985	ARS, Amreli and CRS, Khapat
			2002	CRS, Junagadh
8	5011	Scheme for research in sugarcane	1971	MSRS, Kodinar
9	5012	Scheme for research in grasses forage	1985	GRS, Dhari
10	5013	Str. of research in vegetable (Tomato)	1962	VRS, Junagadh
11	5014	Scheme for research and improvement in fruit crops	1961-62	FRS, Mangrol; ARS (FC), Mahuva and Dept. of Horti., Junagadh
12	5018	Scheme for res. studies in agri. economics	1972	Dep. of Agril. Eco., Junagadh
13	5020	Research in agril. Chem. & soil science	1972	Dept. of Ag. Chem. & Soil Sci., Junagadh
14	5025	Research in agronomy and crop husbandry	2005	Dept. of Agronomy, Junagadh
15	5026	Res. in pest control and other ento. aspect	1960	Dept. of Ento., Junagadh



Sr. No.	Budget Head	Name of Program	Sanction Year	Location
16	5042	Strengthening of dry farming research station	1947-48	Dept. of SST, Junagadh
			1964	DFRS, Vallbhipur
			1965	DFRS, Ratia
			1967	Dept. of Agronomy, Junagadh and DFRS, Jam-Khambhalia
			1975	GRS & ARS, Dhari
			1979	MDFRS, Targhadia
			1995	CRS Khapat
			2011	CRS, Kukada
17	5044	Res. in pl. diseases and other patho. aspect	1985-86	Dept. of Plant Patho., Junagadh
18	5046-A, B & C	Biology investigation & control of weed control, botanical garden and cytogenesis	1969	Dept. of GPB, Junagadh
19	5073	Research in agricultural engineering	1962-63	RTTC, Junagadh
20	5075	Establishment of seed technology cell	1981	DR, Junagadh
21	7082-A	National agriculture research project	1987	MORS, Junagadh
	7082-B	National agriculture research project	1988	MPMRS, Jamnagar
	7082-B	National agriculture research project	1995	DFRS, Jam- Khambhaliya
	7082-C	National agriculture research project	1982	GRS, Dhari
22	9091	NARP Scheme phase-II	1989	CBF, Junagadh
23	9091-9	NARP Scheme phase-II	1989	CBF, Zonpur
24	5353	Livestock research station	1978	CBF, Junagadh
25	7253	Str.Res. in Vet. Sci.&A.H.	1986	
26	5302	State farm for Gir and Kankarej cattle	1949	

### Zonal Research Extension Advisory Committee (ZREAC)

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

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





During the year 2017-18, four meetings of ZREAC were organized; two each at Junagadh and Targhadia. In both ZREAC meetings, five varieties, 50 farmers' recommendations, 32 scientific

recommendations and 114 new technical programs were approved (Table 4.2.2). The feedbacks as well as suggestions were also received from the officers of line departments.

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

Meeting	Place	Date	No. of Participants	No. of Recommendations approved		New Technical Programs
				Farmers'	Scientific	
<b>North Saurashtra Agro-climatic Zones (Zone - VI)</b>						
27 <sup>th</sup> ZREAC (Rabi-summer)	Targhadia	October 12, 2017	78	01	-	06
28 <sup>th</sup> ZREAC (kharif)	Targhadia	January 22, 2018	80	01*+06	02	12
<b>South Saurashtra Agro-climatic Zones (Zone - VI)</b>						
27 <sup>th</sup> ZREAC (Rabi-summer)	Junagadh	October 4-5, 2017	153	2*+10	14	46
28 <sup>th</sup> ZREAC (kharif)	Junagadh	January 16-17, 2018	142	2*+33	16	50
<b>Total</b>			<b>453</b>	<b>05*+50</b>	<b>32</b>	<b>114</b>

\*Variety released

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

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

**Table 4.2.3 Agricultural Research Sub Committees**

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



**Plant Protection AGRESKO Sub-committee Meeting**

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



**Social Science AGRESKO Sub-committee Meeting**

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 ensuring 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 AGRESO meeting.

**Table 4.2.4 Various AGRESO (Discipline wise) meetings organized**

Sub Committee	Date	No. of Participant	No. of Reco.		New Tech. Programs	Ongoing Res. Projects
			Farmers	Scientific		
Social Science	February 6-7, 2018	40	-	08	26	29
Basic Science	February 8-9, 2018	19	02	07	10	47
Agricultural Engineering	February 14-15, 2018	80	10	03	13	29
Plant Protection	February 16-17, 2018	55	14	08	23	179
Horti.& Agro Forestry	February 19-20, 2018	27	02	01	04	28
Animal Science	February 27-28, 2018	58	08	11	13	08
Fisheries Science			03	01	05	25
Crop Production	March 5-6, 2018	45	14	07	25	146
Crop Improvement	March 14-15, 2018	85	07*	-	-	310
<b>Total</b>		<b>409</b>	<b>07*+53</b>	<b>46</b>	<b>119</b>	<b>801</b>

\*Variety released

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

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 AGRESO present the findings of their respective committees for approval. This committee meeting is presided over by the Hon'ble Vice Chancellor. Joint AGRESO will finalize the recommendations and new technical programs for research, which is to be

presented in the ensuing Combined Joint AGRESO of State Agricultural Universities.





The 14<sup>th</sup> Joint AGRESCO meeting was held at College of Agricultural Engineering & Technology, JAU, Junagadh on March 20, 2018 under the chairmanship of Dr. A. R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh. All AGRESCO conveners of various committees presented their reports and approved. Seven new crop varieties, 53 farmers' recommendations, 52 scientific recommendations and 119 new technical programs were approved in the meeting.

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

This is the apex body to finalize the research recommendations at state level as well as the new technical programs. The meeting is held at the venues

in the rotational mode. The members of this committee include Hon'ble Vice Chancellor, Director of Research, Director of Extension Education, Associate Director of Research, Conveners of various 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 the members of the committee. Hon'ble Minister of Agriculture & Cooperation, Govt. of Gujarat also attends the meeting. Separate sessions are organized discipline-wise, in which conveners of various 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 14<sup>th</sup> Combined Joint meeting of the Agricultural Research Council (AGRESCO) of State Agricultural Universities of Gujarat and Kamdhenu University was held at Junagadh Agricultural University, Junagadh during 03-05 April, 2018 under the Chairmanship of Dr. A. R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh. Dr. N. C. Patel, Hon'ble Vice Chancellor, AAU, Anand; Dr. C. J. Dangaria, Hon'ble Vice Chancellor, NAU, Navsari; Dr. A. A.



Patel, Hon'ble Vice Chancellor, SDAU, SKNagar and Dr. P. H. Vataliya, Hon'ble Vice Chancellor, Kamdhenu University, Gandhinagar were the guests of honor. Dr. B. M. Modi, Director of Agriculture, Govt. of Gujarat, Gandhinagar was the special guest. Besides, Directors of Research, Directors of Extension Education, Principals and Deans of various faculties of SAUs and Kamdhenu University, officers from Line Department of Gujarat state, the Associate Directors of Research, the conveners of different sub-committees of SAUs, the senior scientists/professors of SAUs attended the meeting.

Dr. A. R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh endorsed his views on recommendations and new technical programmes presented by the scientists. He discussed about the food and nutritional security, sustainable development growth (SDG) of agriculture sector. He mentioned that monetary return

realized by research is more than the inputs given to it. He also pinpointed various challenges to be faced by us in future with respect to natural resource management, climate change, soil fertility, speed breeding, precision farming, water use efficiency, value additions, farm mechanization, organic farming *etc.*

In the 14<sup>th</sup> Combined Joint AGRESCO meeting, seven varieties *viz.* Groundnut (GG HPS-2), Cotton (GJ.Cot 102 and G.Cot.Hy 22), Brinjal (GRB 5), Tomato (GT 6), Okra (GO 6) and Sesame (GT 6) were recommended for release in the state. Besides, 46 technologies/ recommendations were made for farmers and 41 recommendations were made for scientific community. In addition, as many as 121 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 14<sup>th</sup> Combined Joint AGRESCO meeting of SAUs**

Sub Committee	No. of Recommendations		New Technical Programs
	Farmers	Scientific	
Crop Improvement	07*	-	-
Crop Production	15	07	25
Plant Protection	12	10	23
Horticulture & Agro Forestry	02	01	06
Agricultural Engineering	10	03	13
Animal Science	03	09	13
Fisheries Science	03	01	05
Basic Science	01	07	10
Social Science	-	03	26
<b>Total</b>	<b>07*+46</b>	<b>41</b>	<b>121</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 for different projects are organized by AICRPs. 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 will present results to the quinquennial review team (QRT). All AICRP projects operating in the university are regularly reviewed and monitored as per the ICAR norms. They

identify and evaluate the performance of the research projects according to national standards.

At University level also, under the chairmanship of Hon'ble Vice Chancellor, all AICRP meeting twice in a year is being kept to review project work.



**Monitoring of AICRP of Cotton and Pulses 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 Pearl millet	MPMRS, Jamnagar	May 16, 2017	1. Dr. C. Tara Satyavathi, PC (PM), Jodhpur 2. Prof. Manoj Kumar, ARS, AICRP, Jodhpur
AICRP on Pearl millet	MPMRS, Jamnagar	September 17, 2017	1. Dr. N. Y. Satpute, Breeder & Convener, NARP, Augangabad 2. Dr. G. Guru, Asstt. Prof. and Dr. I. Johnson, Asstt. Prof., TNAU, Coimbatore 3. Dr. Sunita Gupta, Prof., RARI, Jaipur
AICRP on Sesame	ARS, Amreli	September 27-28, 2017	1. Dr. S. R. Kumar, Sesame Breeder 2. Dr. M. Beddis, Niger Breeder 3. Dr. P. K. Soni, Jr. Agronomist 4. Dr. Siba Jasmin, Jr. Entomologist
AICRP- National Seed Project Seed Tech. Res.	MPMRS, Jamnagar	October 03, 2017	1. Dr. P. S. Shukla, JD, GBPUAT, Pantnagar 2. Dr. Bhojaraja N. K., Scientist, IISS, GKVK 3. Dr. N. K. Gupta, Prof., SKNAU, Durgapura
AICRP on Groundnut	MORS, Junagadh	October 06, 2017	Dr. K. S. S. Naik, Principal Scientist; Dr. Venkataramana and Dr. Vemanna, AICRP on Groundnut, ANGRAU, Kadiri, A.P.
AICCP	CRS, Junagadh	November 04-05, 2017	1. Dr. Dilip Monga, Head and Dr. Rishikumar, Principal Sci., CICR, RS, Sirsa 2. Dr. K. S. Baig, Breeder, CRS Nanded 3. Dr. S. Malik, Sr. Agron., PAU, Bhatinda 4. Dr. A. R. Reddy, ICAR-CICR, RS, Nagpur

Name of Project	Department/ Research Station	Date of Monitoring	Name and designation of member of monitoring
AICRP on Pigeon pea	PRS, Junagadh	November 14-15, 2017	1. Dr. R. P. Jayamani, Principal Sci. (Br.) 2. Dr. Rajeshwai, Scientist (Pathology) 3. Dr. Rajbakshar, Scientist (Agronomy)
AICRP on Castor	MORS, Junagadh	January 02, 2018	1. Dr. T. Manjunatha, Sr. Sci., IIOR, Hyd. 2. Dr. Deivamani, Jr. Path., TNAU, Yethapur
All India Network Research Project on Onion & Garlic	VRS, Junagadh	January 24- 25, 2018	1. Dr. K. Singh, Former VC&Chairman, ASRB 2. Prof. T. Marimuthu, Add. Dir., WNRF 3. Dr. R. D. Gautam, Retd. Prof. (Ento.) 4. Dr. Major Singh, Dir., ICAR-DOGR, Pune 5. Dr. Vijay Mahajan, Member Secretary & Pr. Sci. (Hort.), QRT-ICAR-DOGR, Pune
AICRP on LTFE	Dept. of Agril. Chem. & Soil Sci., Junagadh	February 07, 2018	1. Dr. M. Chinnadurai, Member QRT and Prof. & Head, TNAU, Tamil Nadu 2. Dr. B. Mandal, Prof., Bidhan Chandra Krishi Viswa Vidyalaya, Mohanpur 3. Dr. J. K. Saha, Member QRT & Principal Sci., India Insti. of Soil Sci., Bhopal
AICRP on Wheat and Barley	WRS, Junagadh and ARS, Amreli	February 14, 2018	1. Dr. J.B. Singh, Breeder 2. Dr. A. S. Patel, Jr. Sci., SDAU, Vijapur 3. Dr. P. L. Prakasha, Breeder 4. Dr. K. Venkatesh, Sci., IIWBR Karnal
AICRP on Gir germ plasm and data record. unit	CBF, Junagadh	March 17-21, 2018	Dr. Umesh Singh, Project Co-ordinator, AICRP on Indigenous Cattle, ICAR-Central Institute for Research on Cattle, Meerut

**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	MPMRS Jamnagar
2	2004-00	AICRP on Wheat	1987	WRS, Junagadh
3	2008-01G	AICRP on Groundnut	1987	MORS, Junagadh
4	2008-1C	AICRP on Castor	1968	MORS, Junagadh
5	20-1SM	AICRP on Sesame	1986	ARS, Amreli
6	2009-00	AICRP on Cotton	1967	CRS, Junagadh
7	2013-01	AICRP on Vegetable	1988	VRS, Junagadh
8	2258-D	AICRP on Farm imple. & machinery	2015	Dept. of FMPE, CAET, Junagadh
9	2030-01	AICRP on Long term ferti.exp.	1999	Dept. of Ag.Chem.& Soil Sci., JND
10	2040-00	AICRP on Cropping system research	1989	Dept. of Agron., Junagadh
11	2042-01	AICRP on Dry land agriculture	1971	MDFRS, Targhadia
12	2076-02	AICRP on BSP-NSP seed tech.res.	1984	MPMRS, Jamnagar



Sr. No.	Budget Head	Scheme	Sanction Year	Location
13	2258-00	AICRP on Post-harvest technology	1980	Dept. of PFE, CAET, Junagadh
14	2374-00	AICRP on Chickpea	1993	PRS, Junagadh
15	2374-05	AICRP on Pigeon pea	2000	PRS, Junagadh
16	2258-B	AICRP on PET	2005	Dept. of REE, CAET, Junagadh
17	2258-A	AICRP on Ground water utilization	2004	Dept. of SWCE CAET, Junagadh
18	2305-03	Network project on buffalo	2001	CBF, Junagadh
19	2303-08	Gir germ plasm unit	2009	CBF, Junagadh
20	2303-09	Gir data recording unit	2009	CBF, 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	18008-43	Devp. and promotion of promising varieties/ lines with high yield and high oil content with enhanced O/L ratio for enhancing prod. and quality of g'nut oil in drought-prone environ. to boost the income of small and marginal g'nut farmers in India.	2011	ICRISAT, Hyderabad	MORS, Junagadh
2	18005-10	Genetically enhanced micronutrient-dense pearl millet grains for improved human nutrition in the India	2010	ICRISAT, Hyderabad	MPMRS, Jamnagar
3	18246-99	Screening of high biomass populations breeding lines and hybrids in Gujarat	2013		
4	18246-98	Heterotic pool formulation in pearl millet	2015		
5	18053	Creating permanent machinery for studying the cost of cultivation/ prod. of principal crops grown in Gujarat state	1984	DAG, Govt. of Gujarat	Dept. of Agril. Eco., Junagadh
6	18005-04, 05&15	Agricultural demonstration activities in SSP command area Phase-II	2010	SSNNL, Govt. of Gujarat	DFRS, Vallabhipur, Agri. School, Halvad and CRS, Kukada





Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
7	18311-12	Mapping of marine fish biodiversity along the Veraval coast using mtDNA barcoding.	2012	GSBTM, Govt. of Gujarat	CoF, Veraval
8	18005-18	Establishment of model organic farm	2015	GoG	Dept. of Agron., JND
9	18005-01	Experimental agro-met advisory services	1996	GOI	Dept. of Agron., JND/ MDFRS, Targhadia
10	18126-02	Centrally sponsored scheme (Spices)	2006	GOI	VRS, Junagadh
11	18127-00	Seed prod. in agril. crops and fisheries	2006	GOI	MORS & Dept. of SST Junagadh
12	18127-00	Seed prod. in agril. crops and fisheries	2006	GOI	MORS & Dept. of SST Junagadh
13	18803-01 to 12	Megaseed revolving fund	2006		
14	18804-01 to 04	Seed production in agricultural crops	2006		
15	18005-06	Forecasting agril. output using space, agro meteorology and land based observations (FASAL)	2011	GOI	Dept. of Agron., Junagadh
16	18025-04	Effect of optically active substances on diversity in phytoplankton community structure of Gujarat	2013	GOI	FRS, Okha
17	18025-05	Ocean state forecast validation and res. (Okha and Veraval coasts of Gujarat)	2013	GOI	FRS, Okha
18	18003-10	Utilization of chickpea genome sequence for crop improvement	2014	GOI	PRS, Junagadh
19	18246-94	Enzymatic pre-treatment in the processing of pigeon pea	2014	GOI	Dept. of PFE, CAET, Junagadh
20	2012	AINRP on onion and garlic	2009	ICAR-Network	VRS, Junagadh
21	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 Sci., Junagadh
22	2042-02	NICRA - Dry land	2011	ICAR-Network	MDFRS, Targhadia
23	2002-03	National surveillance prog. for aquatic animal diseases	2013		CoF, Veraval
24	2002-5	Implementation of PPV&FR legislation	2002	ICAR-Network	MPMRS, Jamnagar
25	2027-04	Network project on market intelligence	2013		Dept. of Agril. Eco., JND



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
26	2004-1	Project for FLD in wheat		ICAR-Network	WRS, Junagadh
27	2008-3	Project for FLD in sesame	2007		ARS, Amreli
28	2008-11	Need based research on AICRP on castor	-	ICAR-Network	MORS, Junagadh
29	2008-12	Breeder seed prod. of oilseeds crops	2007		
30	2009-1	Remittance of TMC-MM-1 (Cotton)	2007	ICAR-Network	CRS, Junagadh
31	2009-6	Front line demonstration on cotton	2001		
32	2076-3	Central sector special food grain prod.of breeder seed (Revolving fund)	-	ICAR-Network	PRS, Junagadh
33	2254	Study storage losses of food grains	2013	ICAR-Network	Dept. of PFE, Junagadh
34	2259	Testing fees for conduct of AICMIP	2002		MPMRS, Jamnagar/ ARS, Talaja
35	2374-1	FLD on Chickpea	-	ICAR-Network	PRS, Junagadh
36	2374-6	FLD on Pigeon pea			
37	2504-00	Revolving fund horticulture (Nursery)	-	ICAR-Network	Dept. of Horti., JND
38	2704-40	Frontline demonstration on groundnut	1999		MORS, Junagadh/ ARS, Amreli
39	2704-43	Frontline demonstration in pearl millet	1989	ICAR-Network	MPMRS, Jamnagar
40	2002-07	Consortia research platform (CRP) on biofortification	2014		
41	2004-2	Shuttle breeding for developing wheat genotypes for warmer areas	2015	ICAR-Network	WRS, Junagadh
42	18246-95	Initial varietal trial in Pearl millet & <i>Chenchrus setigerus</i> in kharif-2015	2015	ICAR-Network	GRS, Dhari
43	2030-07	Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor	2015	ICAR-Network	Dept. of Biochem., Junagadh
44	2030-08	Transcriptome analysis in coriander for identification of candidate genes against stem gall disease	2015	ICAR-Network	Dept. of Biochem., Junagadh



Sr. No.	Budget Head	Scheme Name	Sanction Year	Sponsoring Agency	Location
45	2030-09	Genome and transcriptome sequencing of cumin ( <i>cuminum cyminum</i> ) to reveal insight of its genomic architecture	2015	ICAR-Network	Dept. of Biochem., Junagadh
46	18132	Creation of seed-hubs for increasing indigenous production of pulses in India	2016	ICAR-Network	Dept. of SST, Junagadh
47	18024-13	Genome and transcriptome sequencing of coriander to reveal insight of its genomic architecture and breeding targets	2016	GOG	Dept. of Biotech., Junagadh
48	18311-17	Evaluation of fish meal substitution with plant proteins in formulated feed in rohu through nutrigenomics approach	2016	GOG	Dept. of Biotech., Junagadh
49	18055-02	Estimation of coconut yield and production in the state of Gujarat	2017	GOI	Dept. of Economics, Junagadh
50	18303-14	Tech. assistance for wild life health care, diseases diagnosis and therapeutic mgmt.	2017	GOG	CoVSAH, Junagadh
51	18802-03	Use of molecular markers in testing genetic purity of dwarf and tall coconut population at Mangrol and Mahuva	2017	GOG	WRS/ Dept. of GPB, Junagadh
52	18803-12	Centre for entrepreneurship development on agri. and allied sci.	2016	GOG	Dept. of SST, Junagadh
53	18009-33	Proliferation of Bt-gene in native cotton varieties of Gujarat	2017	GOG	CRS, Junagadh
54	2009-09	Testing of Bt. Cotton	2017	ICAR	CRS, Junagadh
55	18246-91	River flow simulations integrating satellite data in forested catchment	2017	GOG	CAET, JAU, Junagadh
56	18009-34	Seed infrastructure under NMOOP	2017	GOG	ARS, JAU, Amreli
57	1855-03	Mapping and valuation of eco., social and environ. benefits of conserving Gir Forest area	2018	GOG	Dept. of Agril. Eco., Junagadh

**Half Yearly Report of Junagadh Agricultural University (April to September, 2018)****1. Project profile:**

- a) Component : 1  
 b) Sub-project title: **Institutional Development Plan For JAU, Junagadh**  
 c) Sub-project website address (URL): Nil

**2. Technical Progress:****(i) Technical Progress including project staffing:**

- a) During April – September 2018 (all quantified)
- 200 faculty and students participated in an orientation workshop organized at JAU during March 28-29, 2018 to generate awareness of the IDP Project.
  - 98 students did two basic courses on higher mathematics and computer programming in the

month of June and July, 2018 including 15 days at JAU, Junagadh and 21 days at DA-IICT, Gandhinagar campus.

- Teaching of Machine Learning is presently going on by faculty of DAIICT through video conferencing (virtual class room teaching) at JAU, Junagadh.
- MoU has been signed with DA-IICT to carry out some activities under IDP project.
- Procured 10 computers, 12 Moisture sensors and 4 moisture meters in March, 2018 (2017-18) worth Rs. 6,59,932/- during year 2017-18 (March, 2018). Expenditure made from other state budget.

**b) Major innovations/achievements during the period.**

- a) During the period (in bullets)

S. No.	Innovations / achievements
1	98 students did two basic courses on higher mathematics and computer programming in the month of June and July, 2018 including 15 days at JAU, Junagadh and 21 days at DA-IICT, Gandhinagar campus.

**c) Information on Performance Indicators (April to September 2018)**

(as per the proposal and sanction order)

Sr. No.	Indicator	Target	Achievement
1	Entrepreneurship Courses	1 (50)	0
2	Vocational courses	2 (100)	0
3	Certification courses	0	0
4	Skill development courses	3 (90)	2 (196)
5	Industry linkages	5	2
6	Students internships	1 (50)	0
7	Live projects with industry	0	0
8	Consultancies undertaken	0	0
9	High rated publications	3	3
10	Technologies commercialized	0	0
11	Resource generation	0	0
12	Industry participants	10	5
13	Incubators enabled	0	0
14	Incubates trained	20	0

**ii) Financial Management**

Statement of Budget released and utilization:

(Rs. lakhs)

Head	Total Sanctioned Budget	Fund Released up to September 2018	Fund utilized up to September 2018
<b>Capital</b>			
Office Equipment	7.50	7.50	
Laboratory Equipment	100.00	100.00	
Furniture & Fixtures	5.00	5.00	
Computers & Peripherals	29.92	29.92	
Books & Journals	10.00	10.00	
Minor repair & renovation work	55.83	55.83	
<b>Revenue</b>			
International Level Training	116.25	40.00	
Short visits/Seminars	10.00	10.00	
Workshops	10.00	10.00	
National Level Consultancies	8.33	6.00	
Travel expenses	5.00	5.00	
Contractual Services	78.75	37.17	
Operational Expenditure	312.50	215.00	7.38
Institutional Charges	19.81	12.85	0.90
<b>Total</b>	<b>768.89</b>	<b>544.27</b>	<b>8.28</b>

**Procurement**

During the period from April to September 2018

(Rs. lakhs)

Major items (Above Rs. 5.0 Lakhs)	Budget	Amount spent	Remarks
1		NIL	No Item above Rs. 5.0 lakh

**3) Implementation problems/issues if any and suggestions**

Problems	Suggestions
1. Time constraints for students and faculty to implement targeted goals including new courses on AI /IOT/ Robotics /Drone technology in Agriculture	1. Revision of elective courses 2. Flexibility to introduce and conduct 1 to 2 courses/training in different semesters 3. Flexibility to convert RAW/ELP in to international training

**4) Summary of the progress made so far (half a page) along with one or two tables/photos/illustrations etc**

200 faculty and students participated in an orientation workshop organized at JAU during March 28-29, 2018 to generate awareness of the IDP Project. 98 students did two basic courses on higher mathematics and computer programming in the month of June and July, 2018 including 15 days at

JAU, Junagadh and 21 days at DA-IICT, Gandhinagar campus. Teaching of Machine Learning is presently going on by faculty of DAIICT through video conferencing (virtual class room teaching) at JAU, Junagadh. MoU has been signed with DA-IICT to carry out some activities under IDP project. Procured 10 computers, 12 Moisture sensors and 4 moisture meters in March, 2018 (2017-18) worth Rs. 6,59,932/- during year 2017-18 (March, 2018)

**a. Technical:**



**Inauguration of IDP orientation workshop**



**Class room teaching of Higher mathematics and Computer Programming at DAIICT-Gandhinagar**

**b. Procurement:**



**Soil moisture sensors with recording meters**

### c. Environmental safeguards

Cleaning of the University Campus and offices premises and conversion of waste into compost was carried out.



### d. Social Safeguards

Care of Participation of Students from all the section including women has been taken in selecting 98 students batch from all faculty. These students will be sent for national training. Care will also be taken to select students from all section for international training and other courses to be conducted by the university.

### 4.3 Crop Improvement

#### New crop varieties

Seven varieties viz. Groundnut (GG HPS-2), Cotton (GJ.Cot 102 and G.Cot.Hy 22), Brinjal (GRB 5), Tomato (GT 6), Okra (GO 6) and Sesame (GT 6) were recommended for farmers of the state during 2017-18.

#### Groundnut : Gujarat Groundnut - HPS 2 (GG HPS 2)

Farmers of Gujarat state growing groundnut during *kharif* season are advised to grow large seeded confectionery type groundnut variety Gujarat

Groundnut HPS 2 (GG HPS 2). This variety recorded 13.2 and 14.4 % higher pod yield over the check varieties; GJG HPS 1 (2505 kg/ha) and ICGV 86564 (2478 kg/ha), respectively. It was superior to check varieties in respect to tikka and rust diseases.

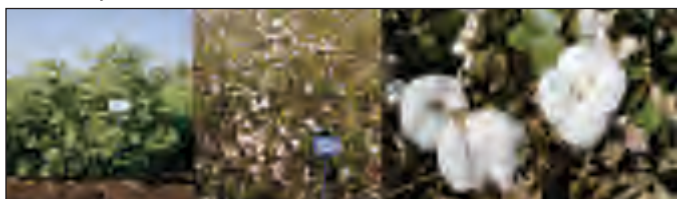
#### Cotton : Gujarat Junagadh Cotton 102 (GJ. Cot 102)

The farmers of Gujarat state growing Non Bt cotton (*Gossypium hirsutum* L.) under irrigated condition are advised to grow variety Gujarat Junagadh Cotton-102 (GJ.Cot 102). This variety has recorded seed cotton yield of 2215 kg/ha, which was 15.9, 24.9, 20.1, 13.2 and 51.8 % higher than the check varieties, G.Cot-10, G.Cot-18, G.Cot 20, GN.Cot 22 and CNHO 12, respectively. The lint yield in GJ.Cot-102 was 769 kg/ha, which was 12.7, 30.8, 20.3, 13.6 and 49.1 % higher than check varieties G.Cot 10, G.Cot 18, G.Cot 20, GN.Cot 22 and CNHO 12, respectively. It has 35.1 per cent ginning outturn and 18.32 % oil content. This variety is medium late in maturity.



### Cotton: Gujarat Cotton Hybrid 22 (G.Cot.Hy 22)

The farmers of Gujarat state growing Non Bt cotton (*Gossypium hirsutum* L.) under irrigated condition are advised to grow hybrid variety Gujarat Cotton Hybrid-22 (G.Cot.Hy 22). The hybrid has recorded 20.4, 48.7, 36.7 and 45.9 % higher seed yield over the checks, G.Cot.Hy 10, G.Cot.Hy 12, GN.Cot.Hy 14 and Ankur 651, respectively. The lint yield in G.Cot.Hy22 is 1010 kg/ha showing yield increment of 26.0, 55.0, 42.2 and 37.3 % over hybrid checks, respectively. It has 34.7 % ginning outturn and 18.37 % oil content. The hybrid is medium late in maturity.



### Brinjal: Gujarat Round Brinjal 5 (GRB 5)

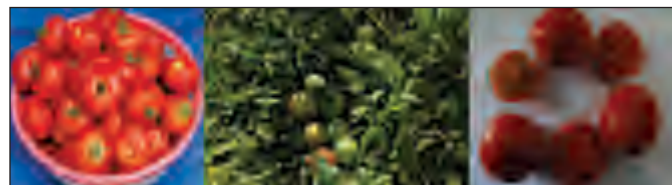
The farmers of Gujarat state growing brinjal crop during late *kharif* season are advised to grow brinjal variety Gujarat Round Brinjal 5 (GRB 5). The variety has recorded 395 q/ha mean fruit yield, which was 10.12 and 24.38 % higher over check varieties; GAOB-2 and GJB-3, respectively. The fruits of GRB5 are medium in size with round shape, light green in colour with purple shadow strip and good shining. The variety was found superior against insect-pests and disease.



### Tomato: Gujarat Tomato 6 (GT 6)

The farmers of Gujarat state growing tomato crop during late *kharif* season are advised to grow tomato variety Gujarat Tomato 6 (GT 6). The variety has recorded 316.05 q/ha fruit yield as against 240.8 q/ha of Anand Tomato 3, 246.9 q/ha of Junagadh Tomato 3 and 248.3 q/ha of National check DVRT 2,

which is 31.23, 27.99 and 27.31 % higher over checks, respectively. The fruits of GT6 are medium in size, flat round in shape with attractive red color and 3 to 4 locules with high T.S.S. It was found superior against leaf curl and fruit borer to all the checks varieties.



### Okra: Gujarat Okra 6 (GO 6)

The farmers of Gujarat State growing okra crop during *kharif* season are advised to grow okra variety Gujarat Okra 6 (GO 6). This variety recorded a mean fruit yield of 125.81 q/ha, which was 13.46, 21.91 and 15.51 per cent higher over check varieties; GJO 3, GAO 5 and Pusa Sawani. The fruits of this variety were smooth, tender, dark green in colour and attractive with green base. The YVMV incidence was found less in variety as compared to all the check varieties at Junagadh and GJO-3 and Pusa Sawani at Anand. This variety was found superior against fruit borer, jassids and white fly to all the checks at Junagadh, while at Anand, the variety was found superior against fruit borer.



### Sesame: Gujarat Til 6 (GT 6)

The farmers of Gujarat state growing sesame in *kharif* rainfed condition are advised to grow sesame variety Gujarat Til 6 (GT 6). The variety recorded the





seed yield of 1010 kg/ha which was 16.6 % higher over the check variety G. Til 4. It contains 49.68 % oil and yielded 502 kg/ha oil which is 17.6 % higher than G. Til 4 (427 kg/ha). The variety possessed white and bold seeds.

#### 4.4 Crop Production

#### Recommendation for Farmers' Community

#### Nutrient Management

#### Comparative efficacy of PSB and bio-phos on the performance of castor

The farmers of South Saurashtra Agro-climatic Zone growing irrigated castor are recommended to apply PSB in soil @ 2.0 L/ha and 40 kg P<sub>2</sub>O<sub>5</sub> along with recommended dose of N and K (120-50 kg/ha) for obtaining higher seed yield and net return.



#### Effect of multi-micronutrient formulations on brinjal

The farmers of South Saurashtra Agro-climatic Zone growing late *kharif* brinjal are recommended to apply micronutrients as per soil test value as base **OR** apply foliar spray of multi-micronutrient formulation Grade IV (Fe-Mn-Zn-Cu-B, 4.0-1.0-6.0-0.5-0.5 %) @ 1% at 45, 60 and 75 DATP in addition to recommended dose of fertilizers (100 - 37.5 - 37.5 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) to brinjal for getting higher yield and net return.



#### Nitrogen management in wheat crop

The farmers of South Saurashtra Agro-climatic Zone growing wheat are recommended to apply nitrogen @ 120 kg/ha in three splits (¼ as basal + ½ at 20 to 25 DAS + ¼ at 35 to 40 DAS) instead of two splits in addition to recommended dose of P<sub>2</sub>O<sub>5</sub>- K<sub>2</sub>O (60 - 60 kg ha<sup>-1</sup>) for getting higher yield, net return and improve nutrient use efficiency.



#### Effect of soil amendments on different varieties of soybean (*Glycine max* L.) under sodic soil

The farmers of South Saurashtra Agro-climate Zone growing soybean in sodic soil during *kharif* season are recommended to grow soybean variety NRC-37 and apply FYM @ 10 t ha<sup>-1</sup> + Gypsum @ 50 % GR along with recommended dose of 30:60:00 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup> for obtaining higher yield and net realization.

#### Effect of nutrients management modules for minimizing drought impact and groundnut yield maximization in rainfed region

The farmers of North Saurashtra Agro-climatic Zone growing semi spreading groundnut crop are recommended to spray urea @ 2% at 30 to 35 DAS along with recommended dose of 12.5-25 N-P kg/ha for obtaining higher yield and maximum net return.

#### Effect of zinc fertilization on wheat yield in sandy loam

The farmers of North Saurashtra Agro-climatic Zone (AES - 10) growing wheat are recommended to apply ZnSO<sub>4</sub> @ 20 kg ha<sup>-1</sup> as basal along with two foliar sprays of ZnSO<sub>4</sub> @ 0.5 % (50 g/10 lit. water) at heading and milking stages with recommended dose of fertilizer (120-60-60 NPK kg/ha) for obtaining higher yield and net realization.

### Cultural Practices

#### Tillage practices for residue management in groundnut-wheat cropping sequence

The farmers of South Saurashtra Agro-climatic Zone who are adopting wheat (*rabi*) - fallow - groundnut (*kharif*) crop sequence are advised to harvest the wheat crop by combine harvester and incorporate the wheat straw in the soil with rotavator and blade harrowing + application of 12 kg N/ha (26 kg urea/ha) + Madhyam culture @ 5 kg/ha and give a light irrigation to the soil through sprinkler irrigation system to secure higher production and profitability of *kharif* groundnut as well as to sustain the soil health.



#### Cropping system diversification and / or intensification

The farmers of South Saurashtra Agro-climatic Zone adopting groundnut (*kharif*) - wheat (*rabi*) cropping system are recommended to replace the system with any one of the following intensified cropping systems to secure higher yield and net profit.

<i>Kharif</i>	<i>Rabi</i>	Summer
Two rows of groundnut (semi spreading) at 60 cm + one row of sweet corn.	Two rows of coriander (seed) at 45 cm + one row of vegetable pea.	Two rows of sesame at 45 cm + one row of vegetable cowpea.
<b>OR</b>		
Clusterbean (seed) at 45 cm.	Paired row of fennel at 60 cm + eight rows of garlic at 15 cm.	Two rows of sesame at 45 cm + two rows of fodder sorghum at 22.5 cm.



#### Groundnut based cropping system under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone adopting bunch groundnut based intercrop system under rainfed condition are recommended to grow groundnut with cotton in 2:1 row ratio for getting higher yield and net return.

#### Moisture stress management in sugarcane

The farmers of South Saurashtra Agro-climatic Zone interested to grow spring-planted sugarcane under

water deficit condition during formative stage are recommended to apply trash mulch @ 5 t/ha at 4-6 days after planting and foliar spray of urea + muriate of potash both @ 2.5 % (2.5 kg urea + 2.5 kg KCl in 100 litres of water) at 60, 80 and 100 days after planting for securing higher cane yield and net return.



#### Irrigation Management

##### Evaluation of precision land levelling in wheat

The farmers of South Saurashtra Agro-climatic Zone growing wheat in *rabi* season are recommended to apply 10 irrigations, first immediately after sowing and remaining 9 irrigations at 8-10 days interval (at 0.9 IW/CPE ratio) for securing higher yield and 10 per cent water saving.



### Effect of different irrigation scheduling and irrigation interval through drip on chickpea

The farmers of South Saurashtra Agro-climatic Zone growing chickpea under drip irrigation system are recommended to irrigate the crop with drip system at 0.8 ETc at 5 days interval through drip after two flood irrigations for getting higher yield, net return and 27 % saving of irrigation water. The system details are as under:

Details	Operating time	
	Month	Minutes
Lateral spacing: 90 cm	December	57
Dripper spacing: 45 cm	January	104
Dripper discharge rate: 4 LPH	February	65
Operating pressure: 1.2 kg/cm <sup>2</sup>		
Operating frequency: every 5 <sup>th</sup> day irrigation		



### Irrigation management through critical stages of chickpea

The farmers of South Saurashtra Agro-climatic Zone interested to grow chickpea under water crisis condition are recommended to irrigate the chickpea crop at four critical stages like branching, flowering, pod initiation and grain filling apart from two common irrigations, first immediately after sowing and second at 6-7 days after sowing for getting higher yield and saving 17 per cent of irrigation water.



### Weed Management

#### Integrated weed management in okra

The farmers of South Saurashtra Agro-climatic Zone growing okra in *kharif* season are recommended to carry out hand weeding at 15, 30 and 45 DAS for effective weed management and achieving higher fruit yield and net realization.



#### Integrated weed management in *rabi* fennel

The farmers of South Saurashtra Agro-climatic Zone growing fennel in *rabi* season are recommended to carry out two hand weeding and inter culturing at 20 and 40 DAS for effective weed management and achieving higher seed yield and net realization.

### Recommendation for Scientific Community

#### Integrated weed management in okra

Under South Saurashtra Agro-climatic Zone, effective weed management along with higher yield and net return in *kharif* okra can be achieved by pre-emergence application of pendimethalin 900 g/ha followed by hand weeding at 40 DAS.



#### Weed management in *kharif* groundnut

Under South Saurashtra Agro-climatic Zone, effective weed management along with higher yield and net return in *kharif* groundnut can be achieved by application of pre-mix pendimethalin + imazethapyr 800 g/ha as pre-emergence *fb* HW and IC at 40 DAS or tank-mix pendimethalin 450 g/ha + oxyfluorfen 120 g/ha as pre-emergence *fb* HW and IC at 40 DAS.



#### Integrated weed management in *rabi* fennel

Under South Saurashtra Agro-climatic Zone, effective weed management along with higher yield and net return in *rabi* direct seeded fennel can be achieved by pre-emergence application of pendimethalin 30 EC 900 g/ha followed by interculturing and hand weeding at 40 DAS.

#### Soil test based fertilizers application for targeted yield of summer groundnut in Saurashtra region of Gujarat

The nutrients requirement for production of one quintal summer groundnut pod was estimated as 4.90, 0.90 and 1.73 kg; N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, respectively. The fertilizer prescription equations are as: for FN (4.14 T

- 0.37 SN - 0.17 FYM), FP<sub>2</sub>O<sub>5</sub> (3.04 T - 1.48 SP - 0.17 FYM) and FK<sub>2</sub>O (6.53 T - 0.43 SK - 0.38 FYM) with FYM and for FN (5.10 T - 0.44 SN), FP<sub>2</sub>O<sub>5</sub> (3.61 T - 1.70 SP) and FK<sub>2</sub>O (7.70 T - 0.48 SK) without FYM. Targeted yield concept could be effectively adopted to bring in site specificity in fertilizer use and achieve high yields of summer groundnut in medium black calcareous soils of Saurashtra region of Gujarat.



#### Establishment of critical limit of sulphur for soybean crop in medium black calcareous soils

For sulphur application to soybean grown on calcareous soils of Saurashtra, critical limit 11.0 ppm in soil and 0.31 per cent in soybean plant at 60 DAS could be considered.

#### Relative salinity tolerance of different castor varieties

It is the information for scientific community, especially for plant breeder that castor variety GCH-7 and GC-3 recorded different salt tolerance criteria *viz.*, higher mean salinity index (82.7 and 84.6), higher mean seed yield (275 and 260 g/plant), minimum yield decline (35.0 and 33.8 %) at 8.0 dSm<sup>-1</sup>



and 50 % yield reduction at EC 10.79 and 10.77 dSm<sup>-1</sup>, respectively, as well as lower Na/K ratio in seed and stalk. Castor variety GCH-7 and GC-3 were found more salt tolerant as compared to GAUCH-1, GCH-2, GCH-4 and GCH-6 on the basis of salinity indices.

#### To study micronutrients and sulphur status in soils of Saurashtra region

The soils of Saurashtra region were found in 'High' categories for available Mn and Cu, while it was 'Low' to 'Medium' status for S, Fe and Zn. Available Fe, Zn, and S were deficient and deficiency was observed in 18, 22 and 36 per cent soils of the Saurashtra region.

#### 4.5 Plant Protection

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

### Recommendation for Farmers' Community

#### Entomology

#### Bio-efficacy of *Beauveria bassiana* in combination with different insecticides against sucking pests of Bt cotton (Bollgard-II)

For effective and economical management of aphid, jassid, whitefly and thrips in cotton, the farmers of South Saurashtra Agro-climatic Zone are recommended to apply five spray of any one of the following

1. Dinotefuran 20 SG 0.01 % (5.0 g/10 litre of water).
2. Diafenthiuron 50WP 0.05% (10.0 g/10 litre of water).
3. Flonicamid 50 WG 0.015 % (3.0 g/10 litre of water).
4. Spiromesifen 22.9 SC 0.011 % (5.0 ml/10 litre of water).
5. Spinosad 45 SC 0.018 % (4.0 ml/10 litre of water).

For ecofriendly management, apply *Beauveria bassiana* 1.15 WP (Min. 2 x 10<sup>6</sup> cfu/g) 0.007% (60 g/10 litre of water), first spray at pest initiation and subsequent four spray should be given at 10 days interval after first spray.

Year	Crop	Pest	Pesticides with formulation	Dosage				Total qty. of Chemical suspension required/ha	Appli-cation schedule	Waiting period/ PHI (days)	Remark (s)
				a.i. g/ha	Quantity of formulation ml or kg/ha	Con (%)	Dilution in water (10 lit.)				
2017-18	Cotton	Aphid, Jassid, Thrips and White fly	Dinotefuran 20 SG	50	0.250 kg	0.01	5 g	500 lit	First spray at pest appearance and subsequent four sprays at 10 days interval after first spray	15	-
			Diafenthiuron 50 WP	250	0.500 kg	0.05	10 g	500 lit		21	-
			Flonicamid 50 WG	75	0.150 kg	0.015	3 g	500 lit		25	-
			Spiromesifen 22.9 SC	57.25	250 ml	0.011	5 ml	500 lit		10	--
			<i>Beauveria bassiana</i> 1.15 WP	2 x 10 <sup>6</sup> cfu/g	3.0 kg	0.007 (Min. 2x10 <sup>6</sup> cfu/g)	60 g	500 lit		--	--



### Evaluation of new pheromone based mating disruption technology for pink bollworm in cotton

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton are recommended to give three application of Sawaj Pheromone based Mating Disruption Paste (Sawaj MDP) technology @ 400g

paste per application per hectare (uniformly distributed in 1000 dots between two branches) against pink bollworm, first at initiation of pest infestation (flowering stage) and subsequent two applications at an interval of 30 days for effective, economical and ecofriendly management.

Year	Crop	Pest	Pesticides with formulation	Dosage				Total Qty. of water required/ha	Application Schedule
				g.a.i./ha	Qty. of formulation g/ha	Conc. (%)	Dilution in water (10 lit.)		
2018	Cotton	Pink boll worm	Sawaj MDP technology	-	1200 g/ha (400 g paste per application per hectare)	-	-	-	First application at pest infestation (flowering stage), while second and third at 30 days interval after first application.



### Microbial management of white grubs in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are recommended to give seed treatment with chlorpyrifos 20 EC @ 25 ml/kg seed and soil application of *Beauveria bassiana* or *Metarizium anisopliae* 1.15 WP @ 5 kg/ha (Min.  $2 \times 10^6$  cfu/g) along with castor cake (300 kg/ha) before

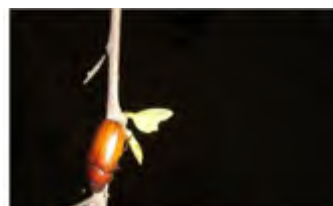
sowing and drenching in plant row after 30 days of germination. For organic farming, soil application of *Beauveria bassiana* or *Metarizium anisopliae* 1.15 WP @ 5 kg/ha (Min.  $2 \times 10^6$  cfu/g) along with castor cake (300 kg/ha) before sowing and drenching in plant row after 30 days of germination for effective and economical management of white grub.



Eggs



Grubs



Adult



Pod damage

Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ ha	Application schedule	Waiting period/ PHI (days)	
				a.i./ha	Quantity of formulation ml, kg/ha	Con. (%)	Dilution in water (10 lit.)				
2017-18	Groundnut	White grub	Chlorpyrifos 20 % EC (ST) + <i>Beauveria bassiana</i> 1.15 WP (SA and drenching)	600 + 57.50	3.0 lit + 5.0 kg	-- (Min. 2 x 10 <sup>6</sup> cfu/ g)	NA 50 g	-- 1000 lit (Drenching)	ST and soil application before sowing and drenching after 30 days of germination	-	
				57.50	5.0 kg						
			OR Chlorpyrifos 20 % EC (ST) <i>Metarhizium anisopliae</i> 1.15 WP (SA and drenching)	600 + 57.50	3.0 lit + 5.0 kg	-- (Min. 2 x 10 <sup>6</sup> cfu/ g)	NA 50 g				
				57.50	5.0 kg						
			OR <i>Beauveria bassiana</i> 1.15 WP (SA and drenching)	57.50 + 57.50	5.0 kg + 5.0 kg	0.006 (Min. 2 x 10 <sup>6</sup> cfu/ g)	50 g	1000 lit (Drenching)			Soil application before sowing and drenching after 30 days of germination
				57.50	5.0 kg	0.006 (Min. 2 x 10 <sup>6</sup> cfu/ g)	50 g				
OR <i>Metarhizium anisopliae</i> 1.15 WP (SA and drenching)	57.50 + 57.50	5.0 kg + 5.0 kg	0.006 (Min. 2 x 10 <sup>6</sup> cfu/ g)	50 g							
	57.50	5.0 kg	0.006 (Min. 2 x 10 <sup>6</sup> cfu/ g)	50 g							

### Effect of insecticides on growth of *Beauveria bassiana*

For mixing *Sawaj Beauveria* with different insecticides, farmers are advised to refer the following table (Yes/No).

SN	Insecticide	At lower dose			At recommended dose			At higher dose		
		Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the insecticides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g)/ 10 lit.	Farmer are advise to mix the insecticides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the insecticides with <i>B. bassiana</i> (Yes/No)
1	Methomyl 40 SP	0.040	10.00	Yes	0.080	20.00	Yes	0.12	30.00	Yes
2	Lambda cyhalothrin 5 EC	0.00125	2.50	Yes	0.0025	5.00	Yes	0.00375	7.50	Yes
3	Thiodicarb 75 WP	0.075	10.00	Yes	0.15	20.00	Yes	0.225	30.00	Yes
4	Chlorpyrifos 20 EC	0.020	10.00	Yes	0.040	20.00	Yes	0.060	30	No
5	Profenophos 50 EC	0.037	7.50	No	0.075	15.00	No	0.112	22.50	No
6	Quinalphos 25 EC	0.025	10.00	Yes	0.050	20.00	No	0.075	30.00	No
7	Spiromesifen 22.9 SC	0.011	5.00	Yes	0.023	10.00	Yes	0.033	15.00	Yes
8	Bifenthrin 10 EC	0.0025	2.50	Yes	0.005	5.00	Yes	0.0075	7.50	Yes
9	Diffubenzuron 25WP	0.012	5.00	Yes	0.025	10.00	Yes	0.037	15.00	No
10	Novaluron 10 EC	0.005	5.00	Yes	0.010	10.00	Yes	0.015	15.00	Yes
11	Fipronil 5 SC	0.005	10.00	Yes	0.010	20.00	Yes	0.015	30.00	Yes
12	Indoxacarb 14.5 EC	0.0036	2.50	Yes	0.007	5.00	Yes	0.0108	7.50	Yes
13	Chlorantraniliprole 18.5 SC	0.003	1.50	Yes	0.006	3.00	Yes	0.009	4.50	Yes



SN	Insecticide	At lower dose			At recommended dose			At higher dose		
		Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the insecticides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the insecticides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the insecticides with <i>B. bassiana</i> (Yes/No)
14	Spinosad 45 SC	0.007	1.50	Yes	0.014	3.00	Yes	0.021	4.50	Yes
15	Imidacloprid 17.8 SL	0.0026	1.50	Yes	0.005	3.00	Yes	0.008	4.50	Yes
16	Acetamiprid 20 SP	0.003	1.50	Yes	0.006	3.00	Yes	0.009	4.50	No
17	Thiamethoxam 25 WG	0.005	2.00	Yes	0.010	4.00	Yes	0.015	6.00	Yes
18	Chlorfenpyr 10 EC	0.0075	7.50	Yes	0.015	15.00	Yes	0.0225	22.50	No
19	Diafenthiuron 50 WP	0.025	5.00	Yes	0.050	10.00	Yes	0.075	15.00	Yes
20	Flubeniamide 480 SC	0.072	1.50	Yes	0.144	3.00	Yes	0.216	4.50	Yes
21	Cartap hydrochloride 50 SP	0.025	5.00	Yes	0.050	10.00	Yes	0.075	15.00	No
22	Emamectin benzoate 5 SG	0.00125	2.50	Yes	0.0025	5.00	Yes	0.00375	7.50	Yes
23	Carbosulfan 25 EC	0.025	10.00	Yes	0.050	20.00	Yes	0.075	30.00	Yes
24	Buprofezin 25 EC	0.025	10.00	Yes	0.050	20.00	Yes	0.075	30.00	No
25	Polytrin 44 EC	0.022	5.00	Yes	0.044	10.00	Yes	0.066	15.00	Yes
26	Dinotefuran 20 SG	0.005	2.50	Yes	0.010	5.00	Yes	0.0152	7.50	Yes
27	Flonicamide 50 SG	0.0075	1.50	Yes	0.015	3.00	Yes	0.0225	4.50	No
28	Acephate 75 SP	0.037	5.00	Yes	0.075	10.00	Yes	0.112	15.00	No
29	Dimethoate 30 EC	0.015	5.00	Yes	0.030	10.00	Yes	0.045	15.00	Yes
30	Azadirachtin 0.15 EC	0.0003	25.00	Yes	0.0007	50.00	Yes	0.0011	75.00	Yes

### Effect of fungicides on growth of *Beauveria bassiana*

For mixing *Sawaj Beauveria* with different fungicides, farmers are advised to refer the following table (Yes/No).

SN	Insecticide	At lower dose			At recommended dose			At higher dose		
		Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the fungicides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the fungicides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g)/10 lit.	Farmer are advise to mix the fungicides with <i>B. bassiana</i> (Yes/No)
1	Sulphur 80 WP	0.100	12.50	Yes	0.200	25.00	Yes	0.300	37.50	Yes
2	Copper oxychloride 50 WP	0.100	20.00	Yes	0.200	40.00	Yes	0.300	60.00	Yes
3	Dinocap 48 EC	0.024	5.00	Yes	0.048	10.00	Yes	0.072	15.00	Yes
4	Metalaxyl 4 + Mancozeb 64 WP	0.102	15.00	No	0.204	30.00	No	0.306	45.00	No
5	Zineb 75 WP	0.100	13.30	No	0.200	26.60	No	0.300	40.00	No
6	Fosetyl-Al 80 WP	0.080	10.00	Yes	0.160	20.00	Yes	0.240	30.00	No
7	Chlorothalonil 75 WP	0.100	13.40	Yes	0.200	26.70	Yes	0.300	40.10	Yes
8	Mancozeb 75 WP	0.093	13.40	No	0.187	26.70	No	0.280	40.10	No
9	Benomyl 50 WP	0.025	5.00	Yes	0.050	10.00	No	0.075	15.00	No
10	Hexaconazole 5 EC	0.0025	5.00	No	0.005	10.00	No	0.0075	15.00	No
11	Carbendazim 50 WP	0.025	5.00	No	0.050	10.00	No	0.075	15.00	No
12	Propiconazole 25 EC	0.013	5.00	No	0.025	10.00	No	0.038	15.00	No



SN	Insecticide	At lower dose			At recommended dose			At higher dose		
		Conc. (%)	Dose (ml/g)/ 10 lit.	Farmer are advise to mix the fungicides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g)/ 10 lit.	Farmer are advise to mix the fungicides with <i>B. bassiana</i> (Yes/No)	Conc. (%)	Dose (ml/g) /10 lit.	Farmer are advise to mix the fungicides with <i>B. bassiana</i> (Yes/No)
13	Thiophanate methyl 70 WP	0.035	5.00	No	0.070	10.00	No	0.105	15.00	No
14	Thiram 75 SP	0.100	13.40	No	0.200	26.70	No	0.300	40.10	No
15	Carboxin 37.5 + Thiram 37.5 DS	0.038	5.00	No	0.075	10.00	No	0.113	15.00	No
16	Metalaxyl 8 + Mancozeb 64 WP	0.0748	10.40	No	0.1497	20.80	No	0.2246	31.20	No
17	Tabucanazole 25 EC	0.013	5.00	No	0.025	10.00	No	0.038	15.00	No
18	Propineb 70 WP	0.070	10.00	No	0.140	20.00	No	0.210	30.00	No
19	Tridimefon 25 WP	0.013	5.00	No	0.025	10.00	No	0.038	15.00	No
20	Mancozeb 63 + Carbendazim 12 WP	0.075	10.00	No	0.15	20.00	No	0.225	30.00	No
21	Azoxystrobin 23SC	0.012	5.00	No	0.023	10.00	No	0.035	15.00	No

### Bio-efficacy of different bio-pesticides and insecticides against pink bollworm in Bt cotton (Bollgard-II)

The farmers growing cotton are recommended to apply five spray of *Beauveria bassiana* 1.15 WP

(Min.  $2 \times 10^6$  cfu/g) 0.009 % (80 g/10 litre of water), first spray at 5 % appearance of rosette flower and subsequent four spray at 10 days interval after first spray for effective and economical management of pink bollworm.

Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ ha	Application schedule	Waiting period/ PHI (days)
				a.i.g/ ha	Quantity of formulation ml, kg/ha	Con. (%)	Dilution in water (10 lit.)			
2017-18	Cotton	Pink boll worm	<i>Beauveria bassiana</i> 1.15 WP	46.00	4.0 kg	0.009 (Min. $2 \times 10^6$ cfu/ g)	80 g	500 lit	First spray at 5% rosette appearance of flower and subsequent four spray at 10 days interval after first spray	-



### Bio-efficacy of selected insecticides against pink bollworm in Bt cotton

The farmers of South Saurashtra Agro-climatic Zone growing *Bt* cotton are recommended to apply any one of the following insecticides, first spray at 75 days after sowing and second at 15 days of first spray for effective and economical management of pink bollworm.

1. Lambda cyhalothrin 2.5 EC, 0.0025% (10 ml/10 lit. of water) or
2. Deltamethrin 2.8 EC, 0.0028% (10 ml/10 lit. of water).



Year	Crop	Pest	Pesticides with formulation	Dosage					Application schedule	Waiting period/ PHI (days)
				g. a.i./ ha	Quantity of formulation ml/ha	Con. (%)	Dilution in water (10 lit.)	Total Qty. of water lit /ha		
2017	Cotton	PBW	Lambda cyhalothrin 2.5 EC	12.5	500	0.0025	10 ml	500	First spray at 75 days after sowing and second after 15 days of the first spray for effective control of pink bollworm.	21
			Deltamethrin 2.8 EC	14	500	0.0028	10 ml	500		-

### Management of ear head worm, *Helicoverpa armigera* (Hub.) infesting bajra crop with bio pesticides

Farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are recommended to spray *HaNPV* @ 450 LE/ha (10 ml/10 lit. water) or *Bacillus thuringiensis* 5 WP ( $2 \times 10^8$  cfu/g) @ 1.0 kg/ha (20 g/10 lit. water) or *Beauveria bassiana* 1.15 WP ( $2 \times 10^6$  cfu/g) @ 2.0 kg/ha (40 g/10 lit. water) on appearance of *Helicoverpa armigera* at ear head stage for effective and economical management of pest.



Year	Crop	Pest	Pesticides with Formulation	Dosage				Total qty. of water required /ha	Application schedule	Waiting period / PHI (days)
				g.a.i. / ha	Qty. of formu g, ml, kg or l/ha	Conc. (%)	Dilution in water (10 lit.)			
2018	Pearl millet (bajra)	<i>Helicoverpa armigera</i>	<i>HaNPV</i> 450 LE/ha	--	500 ml	450 LE/ha	10 ml	500 litre	Single spray at the appearance of <i>H. armigera</i> larva on ear head	--
			<i>Bacillus thuringiensis</i> 5 WP	50	1.0 kg	0.01 (2 x 10 <sup>8</sup> cfu/g)	20g			
			<i>Beauveria bassiana</i> 1.15 WP	23	2.0 kg	0.0046 (2 x 10 <sup>6</sup> cfu/g)	40g			

### Effect of intercrop on the incidence of major insect pests of sesame

Farmers of North Saurashtra Agro-climatic Zone growing sesame in *kharif* are recommended to grow black gram as an intercrop (2 line sesame + 1 line black gram) at the spacing 60 x 10 cm to reduce pest infestation, increase predator activity and to get higher net realization.



### Testing bio-efficacy of insecticides against leaf webber (*Crocidolomia binotalis* Zell) of mustard

The farmers of South Saurashtra Agro-climatic Zone growing mustard in *rabi* season are recommended to apply two spray of chlorpyrifos 20 EC 0.05 % @ 250 g a.i./ha (25 ml/10 liter water) or quinalphos 25 EC 0.05 % @ 250 g a.i./ha (20 ml/10 litre water) at 7 days interval starting from the initiation of pest infestation for effective and economical management of mustard leaf webber.



Year	Crop	Pest	Pesticides with formulation	Dosage				Total Quantity of Chemical suspension required/ ha	Application schedule	Waiting period/ PHI (days)
				a.i.g/ ha	Quantity of formulation ml, kg/ha	Con. (%)	Dilution in water (10 lit.)			
2017-18	Cotton	Pink boll worm	<i>Beauveria bassiana</i> 1.15 WP	46.00	4.0 kg	0.009 (Min. 2 x 10 <sup>6</sup> cfu/ g)	80 g	500 lit	First spray at 5% rosette appearance of flower and subsequent four spray at 10 days interval after first spray	-

### Evaluation of different storage bags against the groundnut bruchid beetle (*Caryedon serratus*) in storage

The farmers of South Saurashtra Agro-climatic Zone are recommended to store fumigated groundnut pods in high density polythene (HDPE) bags or polythene layered gunny bags for effective and economical management of bruchid pest.



### Plant Pathology

#### Management of fungal foliar diseases of cotton

The farmers growing cotton are recommended to apply three spray of pyraclostrobin 5WG + metiram 55WG 0.18 % @ 30 g/10liter of water, first spray at initiation of diseases and subsequent two spray at 15 days interval after first spray for effective and economical management of fungal foliar diseases.

The farmers those interested in organic cotton production are recommended to apply three spray of *Pseudomonas fluorescens* ( $2 \times 10^8$  cfu/g) 50 ml/10 liter of water, first spray at initiation of diseases and subsequent two spray at 15 days interval after first spray for effective and economical management of fungal foliar and bacterial blight diseases.

Year	Crop	Pest	Pesticides with Formulation	Dosage				Total qty. of water required /ha	Application schedule	Waiting period / PHI (days)
				g.a.i. / ha	Qty. of formu g, ml, kg or l/ha	Conc. (%)	Dilution in water (10 lit.)			
2018	Pearl millet (bajra)	<i>Helicoverpa armigera</i>	<i>HaNPV</i> 450 LE/ha	--	500 ml	450 LE/ha	10 ml	500 litre	Single spray at the appearance of <i>H. armigera</i> larva on ear head	--
			<i>Bacillus thuringiensis</i> 5 WP	50	1.0 kg	0.01 ( $2 \times 10^8$ cfu/g)	20g			
			<i>Beauveria bassiana</i> 1.15 WP	23	2.0 kg	0.0046 ( $2 \times 10^6$ cfu/g)	40g			

### Recommendation for Scientific Community

#### Entomology

#### Bio-efficacy of different bio-pesticides and insecticides against pink bollworm in Bt cotton (Bollgard-II)

For effective and economical management of pink bollworm, five spray of spinosad 45 SC 0.014 % (3.0 ml/10 litre of water) or chlorantraniliprole 18.5 SC 0.006 % (3.0 ml/10 litre of water), first spray at 5 % appearance of rosette flower and subsequent four spray at 10 days interval after first spray found effective in cotton.

#### Management of *Helicoverpa armigera* (Hubner) and *Spodoptera litura* (Fabricius) in groundnut through insecticides

For effective and economical management of *Helicoverpa armigera* (Hubner) and *Spodoptera litura* (Fabricius), three spray of indoxacarb 14.5 SC 0.007 % (5.0 ml/10 litre of water) or spinosad 45 SC 0.014 % (3.0 ml/10 litre of water) or chlorantraniliprole 18.5 SC 0.006 % (3.0 ml/10 litre of water), first spray at the initiation of pest infestation and subsequent sprays at 15 days interval after first spray found effective in *kharif* groundnut.

### Management of ear head worm, *Helicoverpa armigera* (Hub.) infesting bajra crop with bio-pesticides

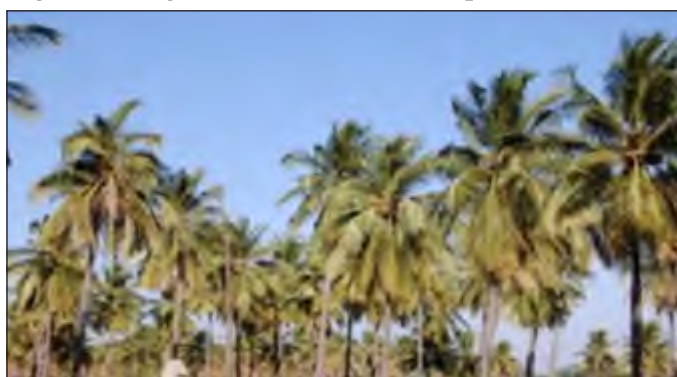
Spray of DDVP 76 EC @ 0.05 % was found effective and economical for the management of ear head worm, *Helicoverpa armigera* (Hub) in pearl millet at ear head stage.

### Testing bio-efficacy of insecticides against leaf webber *Crocidolomia binotalis* Zell) of mustard

The scientific community is informed to apply two spray of ready mixture of profenophos 40 % + cypermethrin 4 %, 44 EC 0.044 % 220 g a.i./ha (10 ml/10 litre of water) or profenophos 50 EC 0.05 % 250 g a.i./ha (10 ml/10 litre of water) or novaluron 10 EC 0.005 % 25 g a.i./ha (5 ml/10 litre of water) at 7 days interval starting from pest infestation for effective and economical management of mustard leaf webber.

### Response of coconut varieties in relation to different seasons for the eriophyid mite damage

The coconut eriophyid mite damage was higher in summer where as it was lower in winter. Higher damage was recorded in dwarf green variety and less damage in west coast tall (WCT), In hybrid variety, higher damage found in D x T as compared to T x D.



### Efficacy of newer insecticides against diamond back moth infesting cauliflower

In South Saurashtra Agro-climatic Zone growing cauliflower in *rabi* season are advised to apply two spray of chlorantraniliprole 18.5 SC 0.006 % (3.2 ml/10 litre of water) at 15 days interval starting from

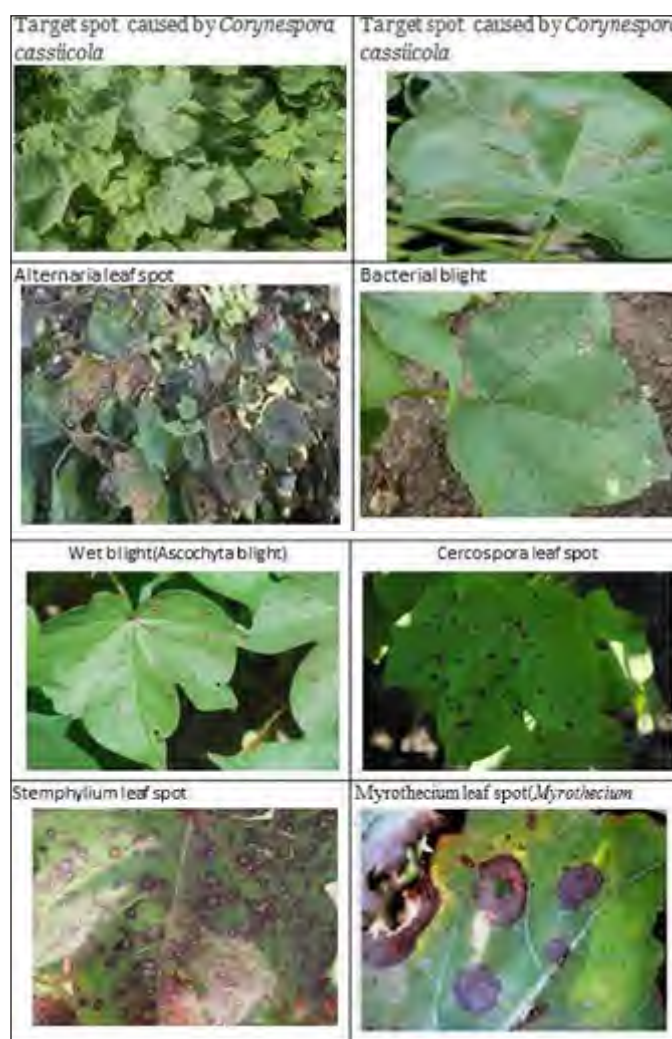
pest infestation for effective and economical management of diamond back moth.



### Plant Pathology

#### Management of fungal foliar diseases of cotton

Three spray of mancozeb 63 WP + carbendazim 12 WP, 0.15 % (20g /10 litre of water) first at initiation of disease and subsequent sprays at 15 days interval was found effective and economical for management of fungal foliar diseases of cotton.



### IDM Package for tomato diseases

For effective and economical integrated management of major diseases of tomato *viz.*, damping off, early blight, tomato leaf curl virus and tomato spotted wilt virus disease and to improve the marketable fruit yield following treatments should be adopted.

1. Seeds of tomato should be treated with seed pro @ 4 g per kg seeds at the time of sowing in nursery and after germination of the seeds soil drenching with seed pro @ 5 % should be carried out.
2. Tomato nursery should covered with 40 - 60 mesh white nylon net until transplanting and at the time of transplanting tomato seedling should be dip with 0.1 % (carbendazim 12 % + mancozeb 63 WP) solution.
3. Maize should be grown as border crop surrounding transplanted tomato field. The foliar sprayings of pesticides should be scheduled as acephate 75 WP @ 1.5 g / litre 10 days after transplanting, fipronil 5 SC @ 1.5 ml / litre 20 DAT, copper hydroxide 77 WP @ 2.0 g / litre 25 DAT and imidacloprid 70 WG @ 2g / 15 litre 40 DAT along with two to three spraying of Fenamidone 10 % + Mancozeb 50 WDG, 0.25 % from 45 DAT at 10 days intervals.

### Studies of weather parameters in relation to initiation and development of stem rot of groundnut

The infection of stem rot in groundnut was commenced in 28<sup>th</sup> std. week, which developed gradually and reached a peak in 33<sup>rd</sup> std. week. All the weather parameters *viz.*, minimum temperature, maximum temperature, morning relative humidity, afternoon relative humidity, soil temperature @ 10 cm, rain fall and rainy days were found significantly co-related in building up the disease incidence in groundnut. The influence of all the weather parameters was found 39.10 per cent.

### Developing IDM modules for the management of cotton diseases

Apply the following Integrated Disease Management Module (IDM) for management of cotton diseases and higher net return.

### IDM Module-1:

1. Seed treatment with *Pseudomonas fluorescens* ( $2 \times 10^8$  cfu/g-JAU isolate) @10 g/kg seed.
2. Soil application of *Trichoderma harzianum* ( $2 \times 10^6$  cfu/g-JAU isolate) @2.5 kg/ha in 250 kg of FYM.
3. Foliar sprays with *Pseudomonas fluorescens* ( $2 \times 10^8$  cfu/g-JAU isolate) 1 % for alternaria leaf spot and copper oxychloride (0.2 %) + streptomycin (0.01%) for bacterial leaf blight on need basis.



OR

### IDM Module- 2:

1. Seed treatment with *Pseudomonas fluorescens* ( $2 \times 10^8$  cfu/g- CICR isolate) @ 10 g/kg seed.
2. Soil application of *Trichoderma viride* ( $2 \times 10^6$  cfu/g-TNAU isolate) @ 2.5 kg / ha in 250 kg of FYM;
3. Foliar sprays with kresoxim-methyl 44.3 SC @ 1ml/lit followed by captan 70 % + hexaconazole 5 % @1.5 g/lit for fungal diseases and copper oxychloride (0.3 %) + streptomycin (0.01 %) for bacterial blight.

Farmers' recommendation of plant pathology approved as scientific information as it is not fulfilling the CIB guide line.



#### 4.6 Horticulture and Agro Forestry

##### Recommendation for Farmers' Community

##### Evaluation of tomato varieties under poly house and net house condition

Farmers of Saurashtra region interested to grow tomato in protected condition are advised to grow indeterminate variety in 60 % white shade net house for getting higher yield and net return.



##### Effect of organic manures in sapota [*Manilkara achras* (Mill)] cv. Kalipatti under saline water irrigation condition

Farmers of Saurashtra region interested to organic cultivation of sapota are advised to apply FYM @ 90 kg/tree (8 year) per year during June-July under saline irrigation water (EC 10-14 dSm<sup>-1</sup>) for obtaining higher yield with net return and for improving soil fertility and microbial status of soil.



##### Recommendation for Scientific Community

##### Estimation of effect of growing degree days (GDD) on phenology, flowering and yield on different mango varieties under Saurashtra Agro-climatic condition

It is observed that the growing degree days (GDD) have direct influence on BDS, flowering, fruit set and various fruit development stages, but not for the physical characters of fruits. The GDD requirements of different varieties were found unique and a mango variety Kesar requires low GDD for maturity with higher Heat Use Efficiency.



#### 4.7 Agricultural Engineering

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

The “Testing and Training Center of Farm Machinery” under the Department of Farm Machinery and Power, CAET, JAU, Junagadh was

established in August, 2008 by the State Govt. with the financial support from the Central Govt. under Rashtriya Krishi Vikas Yojna (RKVY) with total outlay of project as Rs. 535.00 lacs. It is on the line of testing of agricultural machines carried out by Farm Machinery Testing and Training Institutes (FMTTIs), established by the Govt. of India. This Center is one of the twenty five institutions approved by the

Department of Agriculture & Co-operations, Ministry of Agriculture, GoI in the direction of ensuring supply of quality agricultural machinery and equipment under Government programs. Various types of equipments produced by the manufacturer of the state and national level have been received for evaluation of their work performance and feasibility.

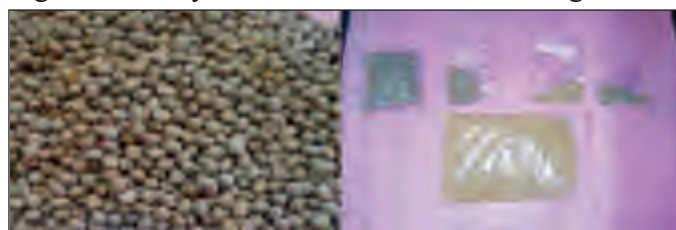
**Table 4.7.1 No. of Farm Machineries/ Implements/ equipments (category wise) tested at testing centre of JAU**

Category	Name of Equipment / Machine	Nos.
A	Land development, tillage & seedbed preparation equipment	50
B	Sowing and planting equipment	11
D	Plant protection equipment	17
E	Harvesting and threshing equipment	31
F	Equipment for residue management	15
<b>Total</b>		<b>124</b>

**Recommendation for Farmers' Community**

**Enzymatic pre-treatment in the processing of pigeon pea**

The pulse processing entrepreneurs are recommended to give enzymatic pre-treatment at specific concentration, time and temperature to get higher recovery and to reduce the *dhal* making time.



**Irrigation scheduling of wheat under high discharge drip irrigation**

Farmers of South Saurashtra Agro-climatic Zone growing wheat in medium black soil are recommended to adopt the drip irrigation system having spacings of 1.8m lateral to lateral and 1m emmitter to emmitter of 14 liters per hour to irrigate at 150 cbar soil moisture tension to get higher net return with 21.04 % water saving and 4 % energy saving. For this, farmers are advised to irrigate the crop with following schedule.

Month	Number of Irrigation	Time of operation	Irrigation interval
November	1	Flood irrigation	Post sowing
December	3	4 hours and 45 minute	10 Days
January	5	3 hours and 40 minute	6 Days
February	3	5 hours and 40 minute	9 Days





### Evaluation of on stream check dam groundwater recharge technique for Junagadh region

It is recommended to farmers, NGOs and line departments of Government on-stream check dam groundwater recharge technique is a cost effective groundwater recharge technique. In Junagadh region, it results 0.15 cum groundwater recharge per square meter of catchment area at the cost of ₹ 1.02 per cum as per prevailing cost.

### Evaluation of groundwater recharge basin technique for Junagadh region

It is recommended to farmers, NGOs and line departments of Government that recharge basin is a cost effective recharge technique. In Junagadh region, it results in recharge about 0.13 cum. groundwater per square meter of catchment area at the cost of ₹ 0.27 per cum.

### Evaluation of roof water harvesting recharge technique for Junagadh region

It is recommended to citizens, farmers, NGOs and line departments of Government that roof water harvesting is an effective groundwater recharge technique. In Junagadh region, it results in groundwater recharge of 0.22 cum out of potential runoff of 0.73 cum per sq. m of roof area, which may be done through tube well recharge and remaining 0.51 cum may be stored in a sump with a cost of ₹34 per cum at prevailing cost. The annual runoff coefficient of 0.71 for roof top is recommended for designing the roof water harvesting system.

### Estimation of irrigation demand for different crops of Ozat river basin using remote sensing and GIS

The irrigation department and planners of Ozat river basin are recommended that based on remote sensing technology, 9 irrigations should be applied for wheat crop in basin apart from pre sowing irrigation at 16, 31, 40, 50, 62, 72, 80, 89 and 96 days after sowing with irrigation depths of 33, 38, 32, 37, 45, 43, 37, 44 and 35 mm, respectively.

### In-situ moisture conservation in rainfed stressed regions for increasing productivity of cotton crop

The farmers of North Saurashtra Agro-climatic Zone growing Bt. cotton G. Cot Hy-8 (BG-II) at the distance of 120 x 45 cm are advised to prepare ridge and furrow OR broad bed with 2 rows (180 cm width) and furrow (60 cm) at 20 days after sowing and apply plastic mulch (25 micron) OR straw mulch @ 5 t/ha at withdrawal of monsoon in the month of September (38 to 39 Std. week) for obtaining higher productivity and maximum net returns as well as maximum *in-situ* moisture conservation and rain water use efficiency under dry farming conditions.

### Development and performance evaluation of tractor drawn cultivator cum spiked roller

The farmers of South Saurashtra Agro-climatic Zone and manufacturers are recommended to use Junagadh Agricultural University developed tractor drawn cultivator cum spiked roller for seed bed preparation. It saves 68.31 per cent cost of operation as compared to traditional method.

### Effect of coloured plastic mulches on cultivation of tomato crop

Farmers of South Saurashtra Agro-climatic Zone are recommended to adopt silver/black or red/black plastic mulch (20 µm) with drip irrigation and raised bed for cultivation of tomato during *rabi* season. This plastic mulch diminishes the infestation of insects/pests and diseases in the crop, controls weeds and results higher crop yield and income.



### Development and performance evaluation of low cost plastic mulch cum drip lateral laying machine

Tractor mounted plastic mulch cum drip lateral laying low cost machine (₹60,000) developed by Junagadh Agricultural University is recommended for farmers' use and for farm machinery manufacturers. It can be used for laying plastic film



with width ranging from 900 to 1500 mm (3 to 5 ft.) along with two lines of drip lateral at a time. It saves about 97.23 % time and 46.03 % cost of laying plastic mulch and drip laterals compared to conventional manual laying method.

### Recommendation for Scientific Community

#### Ambient temperature trend analysis for the South Saurashtra region in view of climate change

The Scientists/ Policy makers in the field of breeding/ climate change adaption are advised to use the following mathematical models to predict the day maximum and day minimum temperature for future period in Junagadh region.

Season	Day Maximum Temperature (°C)		Day Minimum Temperature (°C)	
	Model	R <sup>2</sup>	Model	R <sup>2</sup>
Winter	$T_{max} = 0.0209 * Year - 8.8495$	0.75	$T_{min} = 0.0318 * Year - 49.781$	0.78
Summer	$T_{max} = 0.0191 * Year - 0.1754$	0.84	$T_{min} = 0.0321 * Year - 42.693$	0.84
Monsoon	$T_{max} = 0.0211 * Year - 8.0849$	0.71	$T_{min} = 0.0532 * Year - 81.855$	0.94

### Estimation of irrigation demand for different crops of ozat river basin using remote sensing and GIS

The Planners, NGOs, Field Officers and Government Departments are recommended to use the following relationships to find out crop coefficients of wheat crop with remote sensing images (Landsat) based vegetation indices like Soil Adjusted Vegetation Index (SAVI) and Normalized Difference Vegetation Index (NDVI) for the estimation of crop water requirement.

$$K_c = 1.2588 \text{ SAVI} + 0.4347$$

$$K_c = 1.6741 \text{ NDVI} + 0.5387$$

Where,  $K_c$  = Crop coefficient of wheat crop, NDVI = Normalized Difference Vegetation Index, SAVI = Soil Adjusted Vegetation Index.

### Evaluation of rainfall erosivity index and soil erodibility factor in medium black soil under different cropping systems

Maximum runoff and soil loss was observed in

sole cotton cropping system and cultivated fallow respectively, Minimum runoff with soil loss was observed in absolute fallow followed by sole groundnut cropping system. Soil erosivity factor (45.74) and soil erodibility factor (0.41) were observed in cultivated fallow in medium black soil.

### 4.8 Basic Science

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

### Recommendation for Farmers' Community

#### Effect of growth regulator, organic and inorganic foliar nutrition on the growth and yield of blackgram (*Vigna mungo* L.) under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone-VI growing blackgram in *kharif* under rainfed condition are advised to spray Gibberellic Acid ( $GA_3$ ) 1 g/10 litre water (100 ppm) at flowering (35-40 DAS) and pod development (55-60 DAS) stages for obtaining higher seed yield and net return.

### Recommendation for Scientific Community

#### Effects of 2, 3, 5-Triiodobenzoic Acid (TIBA) on seed cotton (*Gossypium hirsutum* L.) yield

It is informed to scientific community that spray growth regulator TIBA 5g/ha/spray at 50, 60, 70, 80 & 90 DAS to achieve balanced growth and higher seed cotton yield in late maturing Bt cotton hybrids under irrigated condition in South Saurashtra Agro-Climatic Zone. As TIBA is not listed by CIB.



#### Biochemical and molecular characterization of brinjal varieties and promising genotypes

It is informed to the scientific community that brinjal variety GOB-1 was found most distinct among 14 promising genotypes and varieties based on biochemical, nutritional and molecular analysis. It contains higher protein, total soluble solids, soluble sugars, phenols, ascorbic acid, PPO activity, flavanoid contents; lower glycoalkaloids and

acidity. The clustering pattern on the basis of biochemical parameters of brinjal varieties and genotypes correlates with molecular (SSR) based dendrogram depicting most distinct genotype GOB-1 out grouped from other genotypes with 48 per cent similarity.



#### Development of cultivar specific markers for the hybrids released by JAU in pearl millet

The scientific community involved in pearl millet improvement is informed to use below mentioned JAUB series of primers for identification of following hybrids.

Primer Name	Primer Sequence	Product Length	Hybrid
JAUB5F	CTGCTTCTTCTCGTAAT	941	GHB 538
JAUB5R	TTCGCCAGGAGGGCGT		
JAUB7F	ATCGCTACGTCTACGATG	527	GHB 558
JAUB7R	TCTCCGATTAGGTCGTTG		
JAUB17F	TACCTTTGTGTTGATGGTTT	415	GHB 577
JAUB17R	CTACTCTTGTTCCCTCCTCT		
JAUB10F	CAACATACCTCTCGTACGGT	1020	GHB 719
JAUB10R	TTTTTCGGATAGTTCAAACAGT		
JAUB1F	TAGCTGGGTAGAGGCTGACT	249	GHB 526
JAUB1R	GCCTGTTGACAGTCCGTAGA		
JAUB22F	CGCAGTGGATTATCCCTCTC	354	GHB 732
JAUB22R	GGATGACCCTCGAAACCATA		
JAUB24F	GGCATCTCGTTGTACCTCGT	339	GHB 744
JAUB24R	AACAGCATCAGAGCGGACTT		
JAUB27F	CTTGTGCCTTGGAGCTGTTT	550	GHB 757
JAUB27R	GTGGCTGTTGTCATGAATGC		
JAUB30F	TTAGCATTTTGCCTTTGTG	250	GHB 905
JAUB30R	GCATGAATCAGCCATACAA		



### Development of cultivar specific markers for the varieties released by JAU in groundnut

The scientific community involved in groundnut improvement is informed to use below mentioned JAUG series of primers for identification of following groundnut varieties.

Primer Name	Primer Sequence	Product Length	Variety
JAUG12F	CACCAAGTGGGAGAGGAAAA	352	GJG 22
JAUG12R	CCAACACTACCCCATTCTGG		
JAUG13F	GTGGCCAAAGATTTACACA	1201	GJG 17
JAUG13R	GTCCGATGGCAGCTCTATGT		
JAUG1F	GTCGATGAGACGGCTAGTGG	348	GJG 31
JAUG1R	TCGTGACGAGGGTGATCTCT		
JAUG17F	TCGGGATGTGTTTATGTTGC	386	GJG 9
JAUG17R	GGAGTTCGCACATTGTGTTG		
JAUG20F	GCTGGTTAGTTGTGCGGATT	409	GJG HPS 1
JAUG20R	CTCCCCCTTATTGGATAGGC		
JAUG22F	CGAGTATCCCGAACCCTACA	265	GJG 20
JAUG22R	AAAAGGGTTGGTTTCGCTTT		
JAUG4F	CGCACGCATGCCCTAAATAC	355	GG 5
JAUG4R	TTGGGTGCGGATGAGAAAGG		
JAUG26F	TGAGGATTTGCCGTTTCTTT	405	GJG 7
JAUG26R	CCCGTCCCCAAATGATAGAT		
JAUG8F	AAACCGCTGTGTCTCTCTGC	329	GG 11
JAUG8R	GCCTGTTGACAGTCCGTAGA		

### Genome sequencing of pathogenic *Macrophomina phaseolina* isolated from castor

It is informed to the scientific community involved in castor improvement that whole genome sequencing of plant pathogenic fungi *Macrophomina phaseolina* showed 98.6 Mb of genome size. The draft genome has 3061 contigs, 30756 genes, 183303 exons, 28096 SSRs and 13947 repeat regions. In this

genome, 24.30 % of genes are involved in molecular functions, 34.27 % in cellular components and 41.43 % in biological processes. Pathogenicity related genes identified in this study have high relevance in future fungicide designing. The following primers can be used for identification of pathogenic fungi *Macrophomina phaseolina*.

Name	Primer 3'-5'	Product length	GC%	Tm
JAUMPF1	GGAGAGTTTTCGTCAAGTCC	202	55	59.85
JAUMPR1	ACTGTTCGGAGAAACCGAAGA		50	59.84
JAUMPF2	GCGAACTCAATCCCAACATC	226	50	60.47
JAUMPR2	TCGACCATGAGGGTTTTCTC		50	60.05
JAUMPF3	CGCACTAATAATCGGCCCTA	193	50	60.07
JAUMPR3	GTAAAAGTGCGTTGGCGTTT		45	60.17

### In situ detection of potassium status in cotton plants

It is informed to scientific community/ industrialists that silver and carbon nano-particles based portable nano-biosensor has been invented for detection of potassium directly from the leaf sap of

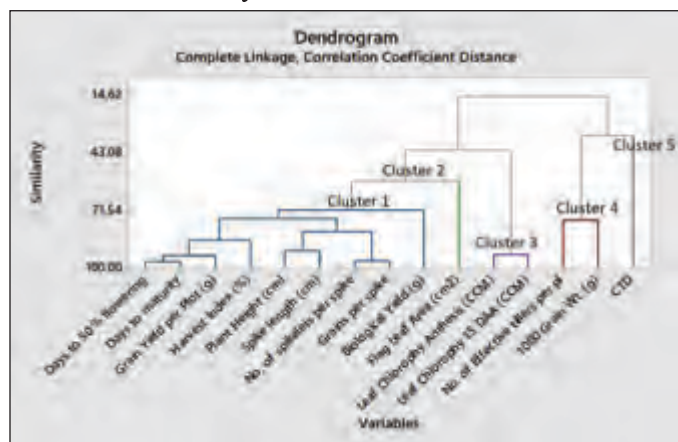
cotton plant with precision. The nano-biosensor works on the basis of ion-selective mechanism to detect potassium ion in the range of 10 to 120 mM. The deficiency of potassium below threshold line of 40 mM from sap with the sensor display indicating the

voltage output below (-ve) 15 mV will be signaled. The onetime cost of the invented nano-biosensor is about Rs.2500-3000 and it works well to detect potassium deficiency level at any growth stage of cotton crop.



**Thermal stress tolerance in wheat (*Triticum aestivum* L.)**

It is informed to scientific community that genotypes J 2010-09 (GW 463) and J 2010-05 are good germplasm sources for wheat improvement for heat tolerance and yield.



#### 4.9 Veterinary Science & Animal Husbandry

Cattle Breeding Farm, Junagadh Agricultural University is the largest and oldest farm and is the only organized research station where purebred *Gir* Cattle and *Jaffrabadi* Buffaloes are maintained in the country. This research station is involved since its inception in conservation, improvement and

advancement of *Gir* Cattle & *Jaffrabadi* Buffaloes through selective breeding. The herd of *Gir* Cattle was established as early as in 1920 by the erstwhile Nawab of Junagadh State, while *Jaffrabadi* herd was established in the year 1978. Since then the 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. 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 Sire Index Values for 1<sup>st</sup> Set of Sires (Gir)**

Sr. No.	Name of Sire	Number of Daughter	Lactation Milk Yield ( kg)	Expected Breeding Value	Rank
1.	Bhavik	59	2570.081	+6.288	2
2.	Bhola	05	2539.085	-24.708	4
3.	Murari	48	2541.141	-22.652	3
4.	Pankaj	51	2714.503	+150.710	1
5.	Raj	18	2525.286	-38.507	5
6.	Rupak	41	2492.661	-71.132	6
	<b>Overall</b>	<b>222</b>	<b>2563.793</b>		

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

Sr. No.	Particular	Gir Bulls	Jaffrabadi Bulls
1.	Frozen Semen doses available from last year (Nos.)	139105	129712
2.	Frozen Semen doses Produced (Nos.)	29700	22365
3.	Frozen Semen doses used for AI in Field (Nos.)	2950	3720
4.	Frozen Semen doses used for AI on Farm (Nos.)	330	320
5.	Frozen Semen doses sold to AI Workers (Nos.)	7725	32770
6.	Frozen Semen doses in Stock (Nos.)	157800	115267
7.	Gir/ Jaffrabadi bulls distributed to Grampanchayat Gaushala, other Institute etc. (Nos.)	50	11

**Table 4.9.3 (a) Total number of cases treated at TVCC**

Types of cases	Cattle	Buffalo	Equine	Canine	Others	Total
<b>Medicine</b>	910	779	190	2529	506	<b>4914</b>
<b>Gynecology</b>	337	337	69	77	47	<b>867</b>
<b>Surgery</b>	589	393	317	725	248	<b>2272</b>
<b>Total</b>	<b>1836</b>	<b>1509</b>	<b>576</b>	<b>3331</b>	<b>801</b>	<b>8053</b>

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

Type of case	Ambulatory Clinic	Clinical Camps
Medicine	1564	30
Gynecology	128	42
Surgery	239	1039
Deworming	-	1111
Vaccination	-	250
<b>Total</b>	<b>1931</b>	<b>2472</b>

**Recommendation for Farmers' Community**

**Seroprevalence of Infectious Bovine Rhinotracheitis (IBR) in dairy animals with reproductive disorders**

Seroprevalence of Infectious Bovine Rhinotracheitis (IBR) in dairy animals is above 30%. Hence dairy farmers of Saurashtra region are recommended to

vaccinate their animals against Infectious Bovine Rhinotracheitis (IBR).

**Clinical studies of foot affections in unsound working horses**

Horse rearers are informed that the prevalence of laminitis is higher during winter; hence they are advised to take appropriate care of the hooves.

### Effect of fogger cooling on body comfort, milk yield and milk composition in Jaffrabadi buffaloes during summer season

It is recommended to dairy farmers that fogger cooling system in loose housing buffalo shed is beneficial in sustaining milk production.



### Recommendation for Scientific Community

#### Evaluation of *in-vitro* antibacterial, anti-inflammatory, antioxidant and anti-diabetic effects of medicinal plants

Crude alkaloid fraction from *Cassia absus* has *in-vitro* antibacterial activity against *Escherichia coli*, *Salmonella typhimurium*, *Streptococcus agalactiae* and *Staphylococcus aureus*.

#### Evaluation of *in-vitro* antibacterial, anti-inflammatory, antioxidant and anti-diabetic effects of medicinal plants

Aqueous extract of *Operculina turpethum* leaves and hydro alcoholic extract of *Sphaeranthus indicus* fruit have *in-vitro* anti-inflammatory activity.

#### Evaluation of *in-vitro* antibacterial, anti-inflammatory, antioxidant and anti-diabetic effects of medicinal plants

Aqueous, alcoholic and hydro alcoholic extracts of *Cressa cretica* leaves have *in-vitro* antioxidant activity.

#### Evaluation of *in-vitro* antibacterial, anti-inflammatory, antioxidant and anti-diabetic effects of medicinal plants

Hydro alcoholic extract of *Luffa echinata* fruit, *Pterocarpus marsupium* bark and extracts of *Cressa cretica* leaves have *in-vitro* anti-diabetic activity.

### Evaluation of healing potential of polyherbal formulation on full-thickness skin wounds in rabbits

Polyherbal formulation containing gel of *Aloe vera* (1 %), defatted alcoholic extract of leaves of *Argyrea speciosa* (0.25 %), hydro alcoholic extract of bark of *Ficus racemosa* (0.25 %), aqueous extract of leaves of *Prosopis juliflora* (1.5 %) and *Tridax procumbens* (0.5 %) has wound healing effect in full-thickness skin excision wound in rabbits polyherbal formulation containing gel of *Aloe vera*, defatted alcoholic extract of leaves of *Argyrea speciosa*, hydro alcoholic extract of bark of *Ficus racemosa*, aqueous extract of leaves of *Prosopis juliflora* and *Tridax procumbens* has wound healing effect in full-thickness skin excision wound in rabbits

### Effect of piperine pre-conditioning on pharmacokinetics of marbofloxacin following subcutaneous administration in rats

Oral administration of piperine does not alter the pharmacokinetics of subcutaneously administered marbofloxacin in rats.

### Seroprevalence of Infectious Bbovine Rhinotracheitis (IBR) in dairy animals with reproductive disorders

Due to high (more than 30 %) seroprevalence of IBR in Saurashtra region, it is advisable to take preventive & control measure.

### Hematological and biochemical aspects associated with haemoprotozoan infection in cows, buffaloes and horses

Hemoprotozoan infection in cows, buffaloes and horses causes anemia with significant increase in serum AST & ALT levels as well as significant change in SOD & MDA levels indicating oxidative stress and oxidative damage.

### Effect of methyl ergometrine and PGF<sub>2</sub> $\alpha$ during puerperium period in Gir cows

It is recommended that a single dose of PGF<sub>2</sub> $\alpha$  immediately after parturition in Gir cows enhances the process of placental separation, hastens the uterine involution, decreases the service period and increases the conception rate.



#### 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. Fisheries Research Station, Sikkahas produced 129.2 lakh pearl oyster larvae. During the year, total 65.36 lakh larvae of pearl oyster were sea ranched to the Gulf of Kachchh to increase the pearl oyster population in Gulf of Kutch, Gujarat. Fisheries Research Station, Okha has produced 558 liters seaweed liquid fertilizer and 252 seaweed greeting cards.

#### Recommendation for Fish Farmers

#### Effects of hurdle technology on biochemical, microbiological, and sensory quality of frozen cut crabs, *Portunus pelagicus*

Frozen cut crabs processors are recommended to apply hurdle technique of pasteurization process at 85 °C for 10 minutes prior to freezing of cut crabs at -40 °C for reduction of bacterial load, lowering drip loss, improvement of sensory quality attributes and shelf life expansion upto 210 days under frozen storage at  $-18 \pm 2$  °C.

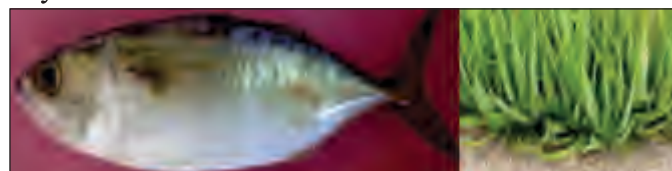
#### Effect of stocking density on growth and survival of juvenile Pacific white shrimp, *Litopenaeus vannamei* (Boone, 1931)

The brackish water shrimp growing farmers are recommended to stock *Litopenaeus vannamei* shrimp seeds @ 25 pc/m<sup>2</sup> to obtain better survival, growth and economical return.



#### Effect of Aloe vera treatment on quality parameters of Indian mackerel (*Rastrelliger kanagurta*, Cuvier-1816) during chill storage

The fisherman/suppliers are recommended to give 20 % *Aloe vera* gel extract dip treatment for 30 minutes before chill storage of Indian mackerel (*Rastrelliger kanagurta*) for better quality up to 15 days shelf-life.



#### Recommendation for Scientific Community

#### Comparison of EPA (Eicosapentaenoic Acid) and DHA (Docosahexaenoic acid) content of four marine micro algae culture

*Isochrysis galbanais* recorded to have 14 % eicosapentaenoic acid while *Chaetoceros* species is recorded to have 3.65 % eicosapentaenoic acid and 11 % docosahexaenoic acid. Hence, scientific community is informed to promote the marine microalgae culture for omega 3 fatty acid.

#### 4.11 Social Science/ Home Science

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

Agricultural economists worked on different research projects *viz.* Farm cost studies of important crops in Gujarat state; An economic analysis of herbicide used on groundnut crops in Saurashtra region of Gujarat state; Development of Optimal Crop Plans (OCPs) for Sustainable groundwater management practices in Saurashtra Region, Gujarat; Export performance of marine products from India; An economic analysis of coconut in Saurashtra region of Gujarat state; 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 different crops *viz.*



groundnut, cotton, castor, cumin, coconut *etc.* were analyzed and for suggestions to farmers.

### Recommendation for Scientific Community

#### Export performance of marine products from India

To overcome price risk and instability the export stabilization fund needs to be created in the marine sector. Sustained focus need to be given on value added marine products, which in turn can lead to diversification in products as well as of markets. For expanding growth and reducing instability in marine products, the exporters may be facilitated to enter into long term contracts with the international buyers. India's maritime export policy needs to be focused big on multilateral negotiations to check the disproportionate or biased use of SPS or TBT measures.

#### Utilization pattern and trends in non-performing assets of crop loan in Junagadh district

Farmers should be encouraged to adopt modern farm technology, mixed farming and micro irrigation system to enhance their repayment capacity. The banks should strongly consider farmers' characteristics such as literacy index, size of farm, irrigation facilities and sources of other income for determining creditworthiness of farmers.

#### Weather based forecasting of wheat productivity in Junagadh district

It is advised that to forecast wheat productivity in the Junagadh district before 6 weeks of harvest, the model based on week wise approach using original weather variables can be used with 12 weeks and 23 years data to have 93.00% accuracy.

The variables affecting the productivity are X1W48, X1W49, X1W50 (Maximum Temperature) of 48<sup>th</sup> week, 49<sup>th</sup> week and 50<sup>th</sup> week, respectively, X2W49 (Minimum Temperature) of 49<sup>th</sup> week, X5W50, X5W52, X5W3 (Bright Sun Shine Hours) of 50<sup>th</sup> week, 52<sup>nd</sup> week and 3<sup>rd</sup> week.

#### Recommended model is:

Model with 12 weeks and 23 years data

$$Y = 12800.97 - 104.92 X1W48 - 84.98 X1W49 - 104.94 X1W50 + 53.92 X2W49 + 361.10 X5W50 + 139.47 X5W52 - 547.67 X5W3$$

$(\bar{R}^2 = 0.93)$

#### 4.12 Human Resource Development

During the year 2017-18, under HRD component of the University, as a part of capacity building for JAU scientists, 156 scientists/teachers were deputed to attend winter/ summer school Short / Refresher Course, Orientation Programme, Short Training, training; 316 attended seminar, symposium, conference, convention; 146 attended the workshops, group / annual / QRT meeting of their respective projects and 141 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 level programs like winter school & seminar as well as one state level seminars/ training / workshops. Among the eight HRD Programmes, organized by University, one of them is National conference on "Technological changes and Innovations in Agriculture for enhancing farmers' Income" organized during May 28-31, 2017 and total 500 scientists/ students were participated in the conference. University has also organized Orientation Workshop on newly sanctioned project of "Institutional Development Plan (IDP)" during March 28-29, 2018 and total 192 scientists/ students were participated in this workshop.

#### 4.13 Mega Seed Unit

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



**Table 4.13.1 Production of truthful, foundation and certified seeds of field crops under mega- seed project**

Sr. No.	Crops	Production (q)		
		Truthful	Foundation	Certified
1	Groundnut	427.99	127.68	983.70
2	Chickpea	210.00	82.50	377.60
3	Sesame	48.82	-	-
4	Wheat	1835.75	-	-
5	Cotton	89.00	-	-
6	Castor	12.00	-	-
7	Cumin	11.50	-	-
8	Coriander	105.00	-	-
9	Soybean	177.03	-	-
10	Mungbean	12.55	-	-
11	Urdbean	69.85	-	-
12	Pigeon pea	53.31	21.00	169.60
13	Sugarcane Setts	730.00	-	-
14	Sorghum	51.99	-	-
15	Garlic	30.00	-	-
16	Onion	37.00	-	-
17	Papaya Seeds	0.50	-	-
18	Vegetable seeds	13.00	-	-
19	Sunhemp	3.00	-	-
	<b>Total</b>	<b>3918.29</b>	<b>231.18</b>	<b>1530.90</b>

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

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

**Table 4.13.2 Production of Nucleus / Breeder Seeds**

SN	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
1	Groundnut	GAUG-10	0.50	5.00	87.80	93.30
		GG-2	-	5.00	33.10	38.10
		GG-11	0.90	-	107.40	108.30
		GG-20	2.10	70.00	1478.75	1550.85
		GG-4	0.10	-	0.90	1.00
		GG-5	0.90	-	59.40	60.30
		GG-6	0.60	-	4.20	4.80
		GG-7	0.60	-	21.60	22.20
		GG-21	-	8.00	-	8.00
		GJG HPS-1	1.00	-	8.00	9.00
		GJG-9	0.45	40.00	60.20	100.65

SN	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
		GJG-31	0.40	30.00	7.10	37.50
		GJG-17	0.90	10.00	125.90	136.80
		GJG-22	1.50	-	513.99	515.49
		GJG-32	1.80	-	9.45	11.25
		<b>Sub Total</b>	<b>11.75</b>	<b>168.00</b>	<b>2517.79</b>	<b>2697.54</b>
2	Pearl millet	ICMA 95444	-	2.50	1.00	3.50
		ICMB 95444	-	0.30	-	0.30
		ICMA 96222	-	0.40	0.33	0.73
		ICMB 96222	-	0.25	-	0.25
		ICMA 98444	-	0.50	0.20	0.70
		ICMB 98444	-	0.20	-	0.20
		<b>Sub Total</b>	<b>-</b>	<b>4.15</b>	<b>1.53</b>	<b>5.68</b>
3	Sesame	G. Til 1	0.03	0.07	-	0.10
		G. Til 2	0.20	2.20	10.82	13.22
		G. Til 3	0.05	3.00	2.85	5.90
		G. Til 4	0.20	0.25	0.20	0.65
		GJT 5	0.05	-	1.91	1.96
		G. Til 10	0.10	0.60	0.85	1.55
		<b>Sub Total</b>	<b>0.63</b>	<b>6.12</b>	<b>16.63</b>	<b>23.38</b>
4	Chickpea	GG 1	0.35	--	16.50	16.85
		GG 2	2.53	--	28.32	30.85
		GJG 3	5.92	39.10	45.00	90.02
		GG 4	0.29	8.00	--	8.29
		GG 5	4.38	--	76.25	80.63
		GG 6	1.28	--	2.50	3.78
		<b>Sub Total</b>	<b>14.75</b>	<b>47.1</b>	<b>168.57</b>	<b>230.42</b>
5	Pigeon pea	GJP 1	0.22	--	30.50	30.72
		<b>Sub Total</b>	<b>0.22</b>	<b>--</b>	<b>30.50</b>	<b>30.72</b>
6	Wheat	GW366	6.00	140.00	15.00	161.00
		GJW 463	2.00	-	20.00	22.00
		GW 496	-	-	70.00	70.00
		Lok 1	-	-	65.00	65.00
		<b>Sub Total</b>	<b>8.00</b>	<b>140.00</b>	<b>170.00</b>	<b>318.00</b>
		<b>Grand total</b>	<b>35.35</b>	<b>365.37</b>	<b>2905.02</b>	<b>3305.74</b>

#### 4.14 Production of *Sawaj* brand bio-agents and microbial products

During the year 2017-18, Department of Plant Pathology has produced and distributed bio-agent *Trichoderma harzianum* under the brand name *Sawaj-Trichoderma* for the management of various

soil borne disease especially stem and pod rot of groundnut in the Saurashtra region. Department also produced and distributed *Sawaj* brand products like *Rhizobium*, *Azotobacter* and PSB liquid bio-fertilizer to farmers, State Departments, other Govt. bodies etc. at reasonable price.

**Table 4.14.1 Production of Sawaj brand bio-agent and liquid bio-fertilizer**

Sr. No	Name of Product	Quantity
1	<i>Sawaj-Trichoderma</i> (tonne)	178.57
2	<i>Sawaj-Rhizobium</i> (Bottle- 500 ml)	5423
3	<i>Sawaj-Azotobacter</i> (Bottle- 500 ml)	4164
4	<i>Sawaj-PSB</i> (Bottle- 500 ml)	6566



Department of Entomology has produced various microbial agents e.g. viruses, bacteria, fungi, protozoans and nematodes are being used in IPM program. Among viral pathogens, nuclear polyhedrosis viruses of *Helicoverpa*(HNPV), *Spodoptera* (SNPV),

entomopathogenic fungi *Beauveria bassiana*, Trichocard, fruit fly trap, fruit fly lure, pheromone trap, pheromone lure are widely used for insect control. These pathogens are highly specific to their host and being considered environmentally safe.

**Table 4.14.2 Production of microbial agents, traps, lure, etc.**

Sr. No.	Name of product	Quantity
1	<i>Beauveria</i> (tonne)	175.40
2	<i>Metarhizium</i> (kg)	1073
3	HNPV (bottle 250 ml)	1147
4	SNPV (bottle 250 ml)	469
5	Trichocard (Nos.)	2382
6	Fruit fly traps (Nos.)	2474
7	Fruit fly lure for fruit crops (Nos.)	2816
8	Fruit fly lure for vegetable crops (Nos.)	484
9	Pheromone Trap (Nos.)	60679
10	Pheromone Lure (Pink bollworm) (Nos.)	134042
11	Pheromone Lure (Heliothis) (Nos.)	25313
12	Pheromone Lure (Prodenia) (Nos.)	4120
13	Pheromone Lure (Brinjal shoot and fruit borer) (Nos.)	368

#### 4.15 Others

**Table 4.15.1 Production of planting material of horticultural and other crops**

Sr. No.	Planting Material	Production (Nos.)
1	Fruit crop graft	22985
2	Fruit crops saplings	26963
3	Seedlings	47635
4	Ornamentals & Medicinal plants	41681
	<b>Total</b>	<b>139264</b>

**Table 4.15.2 Analysis of Soil & Irrigation Water Sample**

Sr. No.	Name of Research Station/ Department	Number of Sample
1	Soil sample analysis	45726
2	Irrigation water analysis	1689
3	Plant sample analysis	43541
	<b>Total</b>	<b>90956</b>

#### 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 4.15.3 Summary of information of improved varieties**

Sr. No.	Crop	Improved variety	No. of FLDs	Total area under FLD (ha)	Yield in IP (q/ha)	Yield in FP (q/ha)	Increase in yield (%)
1	Groundnut (Summer)	GJG-32	19	7.60	19.67	17.45	12.87
2	Castor	GCH-9	30	12.0	35.26	30.99	13.77
3	Pearl millet	GHB 538	22	8.80	46.25	41.98	10.33
		GHB 558 (Summer)	20	8.00	42.06	40.20	4.63
		GHB 732	20	8.00	47.04	42.18	11.57
		GHB 558 (kharif)	12	4.80	30.08	28.58	5.25
		GHB 744	13	5.20	28.62	27.42	4.36
4	Wheat	GJW-463	15	6.00	54.08	48.08	11.00
		GJW-463	19	3.04	57.82	49.86	13.68
		GW-451	8	1.28	48.28	42.65	11.69
5	Coriander	Guj. Coriander -2	9	3.60	12.67	10.56	19.98
6	Cumin	Guj. Cumin-4	6	2.40	12.24	10.28	19.07
7	Fenugreek	Guj. Fenugreek -2	5	2.00	14.74	12.17	21.12
8	Ajwain	G. Ajwain -1	1	0.40	10.85	9.15	18.58

**Table 4.15.4 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	Groundnut ( <i>Kharif</i> )	Whole package	23	9.20	22.63	20.30	11.52
2	Castor	Intercropping (Castor-G'nut)	21	8.40	51.07	21.88	133.50
3	Cotton	Crop Production	32	20.00	27.21	25.06	8.00
		Integrated Cotton Crop Management	20	20.00	25.56	21.81	15.00
4	Pigeon pea (GJG-1)	Seed treatment + Pesticides + Reco. dose of fertilizer	10	10.00	17.93	14.22	26.12
5	Chickpea (GG-5)	Seed treatment + Pest control	10	10.00	29.31	25.08	18.86
6	Sesame	Whole package	20	10.00	5.15	3.87	33.08

**Note:** Improved technology includes crop production, plant protection, horticulture, fisheries, animal science, basic science, social science and agricultural engineering.

**Table 4.15.5 New research programs sanctioned**

Sr. No.	Agency	No. of Research Programs	Amount (Rs. in Lakh)
1	ICAR	01	15.49
2	Govt. of India	-	-
3	Govt. of Gujarat	03	70.64
4	RKVY	02	979.80
5	Other Agencies	11	67.84
<b>Total</b>		<b>17</b>	<b>1133.77</b>

