

# Chapter-IV

# Research







### 4.1 BRIEF REPORT OF RESEARCH ACTIVITIES

The Junagadh Agricultural University comprises of seven districts covering 32.82 per cent area of the state. The University is functioning in a typical Arid and Semi-arid situation where frequent droughts, erratic rainfall, low fertility, salinity ingress are the major constraints for productivity and prosperity of agriculture in this region. The University represents two agro-climatic zones viz., North and South Saurashtra Agro-climatic Zones.

Junagadh Agricultural University has five colleges, 30 research stations include multidisciplinary main research stations, research stations on various crops and research stations/testing centres spread over in South Saurashtra Agro-climatic Zone and North Saurashtra Agro-climatic Zone. These research stations are working in the field of Agriculture, Agricultural Engineering, Animal Sciences and Fisheries for catering the needs of farmers, artisans, livestock holders, fishermen and rural masses for their upliftment. At these research stations, scientists are working hard with sincere efforts for development of high yielding varieties, new improved agronomical practices and pest & diseases management eco-friendly strategies. The research work is also undertaken on natural resource management (bio-diversity, land & water uses), improved farm equipments, post harvest processes and renewable energy. Research efforts are continuing for improvement of cattle breeds, nutritive cattle feeds, fisheries and allied industries. Apart from

these, agricultural information is disseminated through five *Krishi Vigyan Kendras* of the University. The research activities, research accomplishments and recommendations, achievements made by the Junagadh Agricultural University during 2009-10 are given herein.

#### I. CROP IMPROVEMENT

Five new varieties, Groundnut GJG-9, GJG-31, Brinjal GJB-2, Okra GJ-Okra-3 and Sesame G.Til-4 were recommended for cultivation to the farmers during 2009-10.

##### 1. Groundnut: GJG-9

Groundnut variety Gujarat Junagadh Groundnut-9 (GJG-9) recorded overall 30.0, 20.5 and 15.5 per cent higher pod yield over the checks GG-2, GG-5 and GG-7, respectively in *kharif* season. It also displayed higher kernel and oil yield than the checks. It showed tolerant reaction to stem rot disease, jassids and thrips. Due to superior pod and kernel yield, bold kernels and comparable shelling out-turn; the variety GJG-9 is released for cultivation in the *kharif* rainfed groundnut growing areas of the state. The average pod yield is 1632 kg/ha.



##### 2. Groundnut: GJG-31

The summer bunch groundnut variety GJG-31 exhibited 36.9, 24.1, 17.5 and 20.6 per cent higher pod yield over the check GG-2,

GG-4, GG-6 and TG-26, respectively across the years. The variety also showed superiority in pod and kernel features over the check varieties. Due to less damage by jassids and heliothis and free from incidence of bud necrosis (PBND), the variety is released for cultivation in the summer groundnut growing areas of the state. The average pod yield is 3483 kg/ha.



### 3. Brinjal: GJB-2

The brinjal variety Gujarat Junagadh Brinjal-2 (GJB-2) recorded overall 20.9 per cent higher yield over the check variety GOB-1. The fruits of this variety have attractive pink purple colour, medium in size, medium long shape and possess white fruit pulp with less seeds. The variety showed tolerance against little leaf disease. It also showed superiority in quality parameters. The variety is recommended for cultivation during late *kharif* and *rabi* seasons across Gujarat. The average fruit yield is 342.94 q/ha.



### 4. Okra: GJ-Okra-3

The variety Gujarat Junagadh Okra-3 (GJOkra-3) registered 20.6 and 25.7 per cent higher green fruit yield over the check GO-2 and Pusa Sawani, respectively. Further, it also registered 38.4, 49.1 and 71.3 per cent higher yield as compared to Parbhani Kranti, Arka Anamika and Pusa Sawani, respectively. The variety possesses green, tender and attractive fruits. The variety is recommended for *kharif* cultivation in the Saurashtra and South Gujarat region. The average fruit yield is 150.52 q/ha.



### 5. Sesame: Gujarat Til-4

The variety Gujarat Til-4 registered 18.3 and 10.8 per cent yield increment over the check varieties G-Til-2 and G-Til-3, respectively. It also showed per day oil production superiority to the tune of 26.2 and 16.3 per cent over the check varieties G-Til-2 and G-Til-3, respectively. The variety possesses white seeds suitable for export. The variety showed parity with G-Til-2 and G-Til-3 for reaction to capsule borer, gallfly and mites. It has showed earliness to the tune of five to seven days than the check varieties. The variety is recommended for cultivation in the North Saurashtra Agro-climatic Zone. The average seed yield is 770 kg/ha.



### RECOMMENDATION FOR THE FARMERS /SEED PRODUCERS

#### Suppression of interspersed staminate flowers (ISF) in non-environmental sensitive (NES) pistillate line for hybrid seed production of castor

Castor hybrid seed producers are recommended to apply two sprays of ethrel @ 0.05 per cent on pistillate parent (JP-65) at 45 and 65 days after sowing to reduce the number of interspersed staminate flowers (ISF) in racemes of female parent, ultimately to reduce the per cent of selfing in hybrid seed of castor hybrid GCH-6 and to derive more profit per hectare from hybrid seed production programme.

### II. CROP PRODUCTION

This group has released 12 farmers' and three scientific recommendations which are briefed below.

#### I. Nutrient Management

##### Crop rotation studies in respect of sustaining crop yield and increasing total productivity under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone are recommended to adopt integrated nutrient management practices (25% RDF for the respective crop + compost @ 5 t/ha + castor cake @ 500 kg/ha + *Azotobacter*

and PSM @ 5 g/kg of seed) in groundnut based crop rotation with groundnut or sesame or pearl millet for getting higher yield and net realization.

##### Nutrient management practices for sustaining groundnut yield and productivity of sandy loam soils

The farmers of North Saurashtra Agro-climatic Zone (AES-10) growing *kharif* groundnut GG-7 are advised to apply 50% RDF (6.25:12.50 NP kg/ha) along with castor cake @ 500 kg/ha for obtaining higher yield and net realization.

##### Possibilities of organic farming in pearl millet-wheat sequence

The farmers of North Saurashtra Agro-climatic Zone following pearl millet (*kharif*) - wheat (*rabi*) crop sequence are advised to apply 50% RDF to both the crops + FYM @ 5 t/ha + seed inoculation with PSB + *Azospirillum* for pearl millet and *Azotobacter* for wheat to obtain higher yield and net return.

OR

Alternatively, they should apply 100% RDF + 20 kg  $K_2O$ /ha to both the crops for securing higher yield and net return.

##### Response of castor to levels and sources of S

The farmers of South Saurashtra Agro-climatic Zone growing irrigated castor are recommended to apply 20 kg S/ha through gypsum (150 kg/ha) along with recommended dose (75:40 NP kg/ha) as urea and DAP.

OR

The crop should be fertilized with RDF (75:40 NP kg/ha) through urea and SSP for

obtaining higher yield and net return.

### Impact of foliar application of $KNO_3$ on yield and quality of cotton

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton Hybrid (VICH 5) under irrigated condition are advised to spray 3%  $KNO_3$  in addition to RDN (160 kg/ha) at flowering, boll initiation and 50% boll formation to get higher yield and net income.

### 2. Package of Practices

#### Evaluation of tillage practices in castor

The farmers of South Saurashtra Agro-climatic Zone are advised to prepare the land by ploughing followed by cultivator and blade harrowing and sow the *khari*f castor at 90 x 60 cm spacing for getting higher yield and net realization.

#### Evaluation of bunch groundnut cultivars for late sown conditions

The farmers of South Saurashtra Agro-climatic Zone growing bunch groundnut are advised to select variety from the following varieties on priority basis under delayed onset of monsoon situations for realizing higher yield and net return.

**Order of preference:** GG 5, GG 2, J 11, GG 7, TG37A

#### Agronomic evaluation of Bt Cotton hybrid (RCH2)

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton (RCH 2) under irrigated condition are advised to follow spacing of 120 x 45 cm and apply 160 kg N/ha to get higher yield and net income.



### 3. Weed Management

#### Integrated weed management in brinjal

The farmers of South Saurashtra Agro-climatic Zone growing *rabi* brinjal are advised to keep their fields weed free by four hand weeding at 20, 40, 60 and 80 and three interculturings at 20, 40 and 60 days after transplanting.

OR

Under shortage of labourers, apply pendimethalin @ 0.9 kg/ha dissolved in 500 litres of water as pre-emergence + one hand weeding and interculturing at 45 days after transplanting followed by application of pendimethalin @ 0.9 kg/ha with irrigation water for getting higher yield and net realization as well as effective weed control.

#### Evaluation of post emergence herbicides in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut in *khari*f season are advised to keep the crop weed free by three hand weeding and interculturings at 20, 40 and 60 DAS. Under paucity of farm labourers, they are advised to apply pendimethalin @ 1.0 kg/ha as pre emergence and quizalofop ethyl @ 0.050 kg/ha or imazethapyr @ 0.075 kg/ha as post emergence



at 20 DAS for effective weed control and net return.

#### 4. Water Management

##### Relative salinity tolerance of groundnut genotypes

Farmers of Saurashtra region growing summer groundnut variety viz., GG 4, GG 5, GG 6 can irrigate with water having salinity around 2 dS/m.

#### 5. Contingency crop planning

##### Contingency crop planning for varying onset of monsoon situations

The farmers of North Saurashtra Agro-climatic Zone are advised to select crop from the following crops for securing higher income under delayed onset of monsoon situations.

##### Order of preference

**Short duration crops:** Bunch groundnut, Sesame, Pearl millet, Black gram.

**Long duration crops:** Castor, Spreading groundnut, Pigeon pea, Cotton.

#### RECOMMENDATIONS FOR THE SCIENTIFIC COMMUNITY

##### Establishment of critical limit of phosphorus for black gram grown on medium black calcareous soils

The critical limit of available  $P_2O_5$  (Olsen's method) is 24 kg  $P_2O_5$ /ha in medium black calcareous soils and that for P content in leaves (3<sup>rd</sup> leaf) of black gram at 30 DAS is 0.471 per cent.

##### Determination of thermal requirement for different kharif crops under rainfed condition

Based on the field experiment, it was concluded that with delay in onset of monsoon, the Growing Degree Days and Heat Use Efficiency of different crops were tended to decline. The phenophase wise GDD is given herein.

Sr. No.	Particular	Short Duration Crops								
		Sesame			Pearl millet			Black gram		
		I	II	III	I	II	III	I	II	III
	Yield (Kg/ha)	747	547	158	1980	1709	539	667	384	94
	HUE	0.40	0.34	0.10	1.20	1.18	0.38	0.41	0.24	0.07
	Phenophase	Growing Degree Days (GDD)								
1.	Germination	105	125	118	105	132	124	76	94	87
2.	Branching	752	583	558	644	551	569	455	421	355
3.	Flowering	722	377	361	407	298	293	347	318	247
4.	Capsule/pod/ear head formation	370	312	311	327	300	261	525	544	414
5.	Maturity	212	221	172	158	170	128	306	258	254
	<b>Total</b>	<b>1862</b>	<b>1619</b>	<b>1517</b>	<b>1641</b>	<b>1452</b>	<b>1375</b>	<b>1708</b>	<b>1635</b>	<b>1356</b>



Sr. No.	Particular	Long duration crops								
		Cotton			Castor			Spreading G'nut		
		I	II	III	I	II	III	I	II	III
	Yield (Kg/ha)	531	357	96	1597	1350	467	665	443	36
	HUE	0.17	0.13	0.04	0.51	0.49	0.19	0.29	0.22	0.02
	Phenophase	Growing Degree Days (GDD)								
1.	Germination	115	113	123	153	133	123	153	153	123
2.	Branching	808	715	679	876	768	639	700	647	463
3.	Flowering	1093	1009	749	1156	1051	821	443	422	326
4.	Capsule/pod/ear head formation	722	620	417	545	486	308	593	495	401
5.	Maturity	384	336	257	365	257	277	436	451	402
	<b>Total</b>	<b>3120</b>	<b>2792</b>	<b>2224</b>	<b>3092</b>	<b>2694</b>	<b>2167</b>	<b>2325</b>	<b>2066</b>	<b>1715</b>

GDD= Growing Degree Days, HUE= Heat Use Efficiency  
 Where, I Onset of monsoon, II 15 days after onset of monsoon,  
 III 30 days after onset of monsoon

**Relative salt tolerance of different groundnut genotypes in simulated saline soils**

Based on the biomass yield and Na/K ratio in haulm of spreading type GG 13, semi-spreading type GG 20 and bunch type J 33533 varieties of groundnut were found tolerant to 2 ECe (dS/m) salinity. Whereas, GG 20 (semi-spreading) and J 33533 (bunch) were found more tolerant to higher salinity (4 dS/m ECe) than other varieties.

**III. PLANT PROTECTION**

The research work carried out by plant protection group is to develop the economically viable plant protection technology for increasing production of agricultural commodities without any adverse effect on the environment and livelihood of the people. Nine recommendations from Agricultural Entomology group and seven from Plant Pathology group were released.

**Agricultural Entomology**

**Field efficacy of bio-pesticides against thrips in onion (bulb purpose)**

Farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of *Beauveria bassiana* @ 2.0 kg/ha or *Metarhizium anisopliae* @ 1.5 kg/ha at 10 days intervals starting from pest infestation for effective and economical bio-pesticide based management of thrips in rabi onion (bulb purpose).

**Management of pest complex in brinjal through bio-pesticides**

Farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of *Metarhizium anisopliae* @ 1.0 kg/ha combined with endosulfan 35 EC 0.035 % (10 ml/ 10 l) or *Beauveria bassiana* @ 1.0 kg/ha combined with endosulfan 35 EC 0.035 % (10 ml/ 10 l) or *Metarhizium anisopliae* @ 2.0 kg/ha at 10 days intervals starting from pest infestation for effective and economical bio-pesticide based management of brinjal





sucking pests i.e. jassid and whitefly in *rabi* season.

### Management of shoot fly and stem borer in bajra crop

Farmers of North Saurashtra Agro-climatic Zone growing bajra crop are advised to apply two sprays of endosulfan 35 EC 0.07% (20 ml/10 l) or profenophos 50 EC 0.05% (10 ml/10 l) or fenobucarb 50 EC 0.1% (20 ml/10 l) at 20 and 40 days after germination for the control of shoot fly and stem borer.

### Development of low cost protection technology for sorghum shoot fly, [*Atherigona soccata*(R)]

Farmers of North Saurashtra Agro-climatic Zone growing sorghum for fodder purpose in *kharif* season are advised to give seed treatment with imidacloprid 70 WS @ 5 g/kg seeds and two sprays of neem seed kernel extract 5% at 7 and 14 days after germination for the management of shoot fly.

### Management of sesame leaf webber/capsule borer through insecticides

Farmers of North Saurashtra Agro-climatic Zone growing sesame in *kharif* season are advised to apply three sprays of endosulfan 35 EC 0.07% (20 ml/10 l) at vegetative i.e. 30 days, flowering i.e. 45 days and capsule i.e. 60 days of crop for effective and economical management of leaf webber.

### Testing of newer molecules of pesticides against sucking insect pests of groundnut

Farmers of North Saurashtra Agro-climatic Zone cultivating groundnut under rainfed condition are advised to apply imidacloprid 17.8 SL 0.007% (4 ml/10 l) or

thiamethoxam 25 WS 0.01% (4 g/10 l) or acetamiprid 20 SP 0.004% (2 g/10 l) at ETL of aphid (1.5 aphid index/plant) and jassid (3 nymphs/3 top leaves) for effective and economical control of these pests.

### Integrated management of insect pests and diseases of groundnut under rainfed condition

Farmers of North Saurashtra Agro-climatic Zone cultivating groundnut under rainfed condition are advised to spray the tank mixture of insecticides and fungicides in schedule i.e. schedule 1: dimethoate 30 EC @ 10 ml + mancozeb 75 WP @ 26 g/10 l at 35 days after sowing (DAS), methyl-o-demeton 25 EC @ 10 ml + carbendazim 50 WP @ 5 g/10 l at 50 DAS, and endosulfan 35 EC @ 20 ml + mancozeb 75 WP @ 26 g/10 l at 65 DAS or schedule 2: thiamethoxam 25 WG @ 4 g + hexaconazole 5 EC @ 10 ml/10 l at 35 DAS, acetamiprid 20 SP @ 2 g + chlorothalonil 75 WP @ 25 g/10 l at 50 DAS and imidacloprid 17.8 SL @ 4 ml + carbendazim 50 WP @ 5 g + mancozeb 75 WP @ 26 g/10 l at 65 DAS for effective and integrated management of the sucking insect pests i.e. aphids, jassids and thrips and diseases i.e. tikka and rust.

### Testing of new insecticides against sucking pests in groundnut

Farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advised to give seed treatment with imidacloprid 600 FS @ 3 g/kg seed or thiamethoxam 70 WS @ 1 g/kg seed or dimethoate 30 EC 0.06% (20 ml/10 l) as foliar spray at 15 and 30 days after sowing for effective and economical management of thrips and jassid.

**Bio-efficacy of insecticides against thrips in groundnut**

Farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advised to spray profenophos 40 EC + cypermethrin 4 EC 0.044 % (10 ml/10 l) or thiamethoxam 25 WG 0.006 % (2.4 g/10 l) or imidacloprid 17.8 SL 0.005 % (2.8 ml/10l) or methyl-*o*-demeton 25 EC 0.025 % (10 ml/10l) or endosulfan 35 EC 0.07 % (20 ml/10l) at the initiation of the pest for effective and economical management of thrips.

**Plant Pathology**

**Chemical control of powdery mildew of mango**

Farmers of South Saurashtra Agro-climatic Zone cultivating mango are advised to apply three sprays of hexaconazole 5 EC 0.005% (10 ml/10 l) or propiconazole 25 EC 0.025% (10 ml/10 l) at 20 days intervals from initiation of flowering for effective and economical management of powdery mildew.



**Chemical control of Colletotrichum and Cercospora leaf spots of urdbean**

Farmers of South Saurashtra Agro-climatic Zone growing urdbean are advised to apply

three sprays of propiconazole 25 EC 0.025% (10 ml/10 l) or hexaconazole 5 EC 0.005% (10 ml/10 l) at 15 days interval from the disease initiation for effective and economical management of Colletotrichum and Cercospora leaf spot.



**Evaluation of fungicides for the control of downy mildew disease of bitter melon**

Farmers of South Saurashtra Agro-climatic Zone growing bitter melon are advised to apply three sprays of metalaxyl MZ 72 WP, 0.1% (14 g/10 l) or chlorothalonil 75 WP, 0.1 % (13.3 g/10 l) or fosetyl-Al 80 WP, 0.1% (12.5 g/10 l) at 15 days interval from the disease initiation for effective and economical management of downy mildew.





### Management of stem rot of groundnut (*Sclerotium rolfsii*) by different methods of application of *Trichoderma* sp.

The farmers of South Saurashtra Agro-climatic Zone cultivating groundnut are advised to treat the seed with talc based *Trichoderma viride* @ 10 g/kg seeds or apply *T. viride* @ 2.5 kg/ha as soil drenching at 30 days after sowing or *T. viride* @ 2.5 kg along with either castor cake or FYM @ 100 kg/ha in furrow at the time of sowing to reduce stem rot incidence.

### Management of *Meloidogyne arenaria* and *Sclerotium rolfsii* complex in groundnut

The farmers of South Saurashtra Agro-climatic Zone cultivating groundnut are advised to treat the seed with talc based *Pseudomonas fluorescens* @ 20 g/kg seeds followed by the application of *Pseudomonas fluorescens* in furrow @ 2.5 kg/ha for effective management of root knot nematode and stem rot diseases.

### Biological control of angular leaf spot disease of cotton

Farmers of South Saurashtra Agro-climatic Zone growing cotton are advised to treat the seeds with talc based *Pseudomonas fluorescens* (Pf-1) @ 10 g/kg seed along with foliar sprays of *P. fluorescens* (Pf-1) @ 0.2 % (20 g/10 l) at 30, 50, 70 and 90 days after sowing for effective and economical management of angular leaf spot disease.



### Chemical control of Alternaria leaf spot of sesame

Farmers of North Saurashtra Agro-climatic Zone cultivating sesame are advised to apply three sprays of propiconazole 25 EC 0.025% (10 ml/10 l) or cymoxanil 8 WP + mancozeb 64 WP 0.1% (20 g / 10 l) or mancozeb 75 WP 0.2% (25 g/10 l) first at 40 days after sowing and subsequent sprays at 12 days interval for effective and economical management of alternaria leaf spot disease.

### IV. HORTICULTURE & AGRO-FORESTRY

This group has released five farmers' recommendations which are briefed below.

#### Pruning trial on gunda (*Cordia dichotoma*)

The farmers of South Saurashtra Agro-climatic Zone are advised to prune 75% length of one year old branches of gunda from all sides of the tree in 1<sup>st</sup> week of June to get higher yield and economic return.

#### Integrated nutrient management in custard apple cv. Sindhan

Farmers of South Saurashtra Agro-climatic Zone are advised to apply 100g N + 50 g P<sub>2</sub>O<sub>5</sub> + 25 g K<sub>2</sub>O + 2.5 kg castor cake per adult custard apple tree cv. Sindhan at first rainfall in monsoon to get higher fruit yield and net profit.

#### Post harvest treatment for enhancement of ripening of Kesar mango

It is recommended that the freshly harvested mature mango fruits of cv. Kesar should be treated with ethrel @ 750 mg /l of water for 5 minutes and kept at room temperature to

enhance the ripening and get maximum ripened and marketable fruits at 9<sup>th</sup> day.



**Nutrient management in coconut garden through organic manures**

The coconut growing farmers of South Saurashtra Agro-climatic Zone are advised to apply half dose of recommended chemical fertilizers i.e. NPK 200:160:750 g per palm per year along with 5 kg castor cake in two equal splits (June & October) to coconut cv. West Coast Tall to obtain higher nut yield with improvement in nut quality and soil fertility.

**Evaluation of chrysanthemum (*C. morifolium* R.) varieties**

The farmers of South Saurashtra Agro-climatic Zone interested to grow flower crop of chrysanthemum are advised to grow variety IHR-6 for getting higher yield and maximum monetary return.



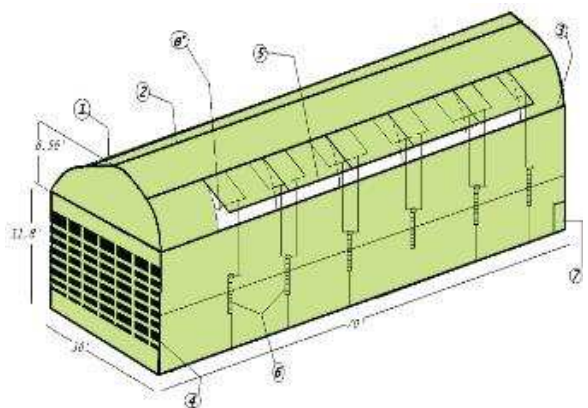
**V. AGRICULTURAL ENGINEERING**

The Agricultural Engineering group accomplished the studies on design, development and fabrication of agricultural machinery, equipments, tools and processes. Agricultural Engineering group has five farmers' and two scientific recommendations.

**RECOMMENDATIONS FOR FARMING COMMUNITY**

**Design and development of SPV operated greenhouse ventilation system**

The farmers/greenhouse growers and greenhouse manufacturers are recommended to use JAU SPV operated Greenhouse Ventilation System for natural ventilation of greenhouses built in farms, where frequent power cut may cause greenhouse environment unfavourable for crop cultivation.





### Performance of bio-degradable plastic mulch on onion production in comparison of normal plastic mulch

Farmers of Saurashtra region are advised to use bio-degradable plastic mulch (20  $\mu$ , black colour) for the cultivation of onion for the higher yield of the crop (15%) and to reduce weed growth (50-62%) as compared to no mulch. After harvesting of the crop, the field should be ploughed for mixing mulch in to the soil.

### Storage study of wheat obtained by combine harvester and thresher

Farmers growing wheat for seed purpose are advised to use thresher for better germination and vigour as compared with self propelled combine harvester.

### Studies on drying characteristics of vegetables using crop residue dryer

The agro processor interested in using the crop residue based dryer developed by

Junagadh Agricultural University for drying serrated carrot, carrot slices, cabbage leaves, cauliflower pieces, tomato slices and whole green chillies are recommended to use following operating parameters :

1. Air temperature : 51 to 55 °C
2. Air velocity : 1.5 m/s
3. Bed thickness : 8.0 cm
4. Average fuel required : 5.5 kg/h

### Evaluation of the size of the bed at a given grade for effective soil and water management

The farmers of North Saurashtra Agro-climatic Zone growing bunch groundnut (GG-5) are advised to sow groundnut at 30 cm distance between rows having three rows on broad bed of 90 cm and furrow of 45 cm for getting higher yield and net return per hectare as well as to check runoff and soil loss under dry farming condition.

### RECOMMENDATIONS FOR THE SCIENTIFIC COMMUNITY

#### Determination of aquifer properties of the wells of Junagadh region

The aquifer properties *viz.*, transmissibility and storage coefficient for different talukas of the Junagadh district are recommended for the scientific community, Government/Non Government Organizations for crop planning and simulating groundwater behaviour for adopted cropping pattern as below.



**Aquifer properties of different talukas of Junagadh district**

Sr. No.	Taluka	Tested Site	Aquifer properties	
			Transmissibility (m <sup>2</sup> /h)	Storage coefficient
1	Vanthali	Vanthali	0.55	0.1919
2	Manavadar	Manavadar	1.187	0.0000358
3	Visavadar	Visavadar	0.7065	0.0002272
4	Mangrol	Mekhadi	6.439	0.1655
5	Junagadh	Junagadh	4.36057	0.0047
6		Bamangam		
7	Una	Keshariya	3.3697	0.00011264S
8	Kodinar	Vadanagar	1.141	0.0001614
9	Sutrapada	Amrapur	9.65	0.108223
10	Mendarada	Amargadh	9.072	0.0013881
11	Talala	Chitrod	33.8846	0.061592
12	Veraval	Supasi	44.553	0.1267303
13	Keshod	Pipari	13.30	0.0000982164
14	Bhesan	Sukhpur	14.2165	0.0252
15		Khambhaliya		
16		Bamangadh		
17		Samatpara		
18	Malia	Vadia	19.3192	0.033766
19		Panakava		
20		Itali		
21		Babara		
22		Dudhala		

**Determination of water front advance under different dripper (emitter) discharge rates in medium black soil**

- (i) At any given duration of water application, the wetted diameter at soil surface increased with increase in dripper discharge rate.
- (ii) Time to reach a particular wetted soil depth is more with low discharge rate of the dripper as compared to higher discharge rate of the dripper.
- (iii) The following relationships between

time of application and depth of soil can be used in medium black soils for emitter discharge rate of 2, 4, 8 and 16 lph, respectively.

$$t = 16.889 Z^{1.1951}$$

$$t = 12.474 Z^{1.3325}$$

$$t = 11.574 Z^{1.2625}$$

$$t = 6.0753 Z^{1.5547}$$

where, t = Time of application (time to reach water at funnel outlet), min  
 Z = Depth of soil (depth of funnel placement), cm



- (iv) The following relationships between diameter of wetted soil at surface and depth of soil can be used in medium black soils for emitter discharge rate of 2,4,8 and 16lph, respectively.

$$W = 7.175Z^{0.4534}$$

$$W = 7.242Z^{0.5545}$$

$$W = 7.807Z^{0.6138}$$

$$W = 8.208Z^{0.6858}$$

where, W= Diameter of wetted soil surface, cm; Z=Depth of soil, cm.

### VI. BASICSCIENCE

The research work carried out by basic science group is research on quality differences in Kesar mango of different location of Saurashtra, varietal identification of onion and garlic through molecular marker, bioactivity in cow urine, biochemical mechanism of *Trichoderma* spp. for inhibition of *Fusarium oxysporum* f. sp. *ciceri* causing chickpea, molecular characterization of indigenous mango cultivars through DNA finger printing, biochemical and physiological markers for wheat varieties against high temperature stress, estimation of pesticide residues from soil and water resources of Saurashtra region, estimation of pesticide residues in vegetables of Junagadh region and surface micro-flora and pathogenic bacteria analysis of fresh vegetables, effect of induced dormancy on the quality of groundnut seed during storage, check the packaging material for the storage of groundnut pod, seed germination in *Malkankani*, effect of brassinolide on germination and biochemical parameter of chickpea, *In vitro* clonal propagation in *Leptadenia reticulata* & *Gloriosa superba*, induction of somaclonal variation in *Trachyspermum ammi* and *Allium sativum* by

callusculture.

### VII. SOCIALSCIENCE

Agricultural economists worked on the different research projects like, farm cost studies of important crops in Gujarat state, technical efficiency in major oilseed production in Saurashtra, establishing and networking of agricultural market intelligence centres in India (NAIP-AMIC), visioning policy analysis and gender (NAIP-V-PAGE), tracking change in rural poverty in household & village economics in South Asia (ICRISAT) and harnessing opportunities for productivity enhancement (ICRISAT). Under NAIP-AMIC project, three price forecasts *viz.*; groundnut, mustard and gram were published for benefits of farmers in eight *Gujarati* news papers. Extension educationists conducted study on knowledge and adoption of animal husbandry practices followed by *Gir maldharis* in Gir area of Gujarat state and case study of Jamka village on impact of water harvesting on socio-economic patterns.

### VIII. FISHERIESSCIENCE

This group has released two fish farmers' and one scientific recommendation which are briefed below.

#### RECOMMENDATIONS FOR FISH FARMERS

**Standardization of transportation method for the freshwater mussel *Lamellidens corrianus***

It is recommended to fish farmers that freshwater mussel (*Lamellidens corrianus*) in the Saurashtra-Kutch region can be transported by road using wet gunny bags up to eight hours.

### Artemia (*Artemia fransiscana*) cyst production in varying salinity

It is recommended to salt paners and aquaculturist of coastal Saurashtra to use 160 ppt salinity of sea water as a rearing medium for *Artemia (Artemia fransiscana)* to obtain higher cyst production.



### RECOMMENDATION FOR SCIENTIFIC COMMUNITY

#### Qualitative analysis of phytoplankton in freshwater culture pond

Seven genera of phytoplankton viz., *Chlorella*, *Scenedesmus*, *Microcystis*, *Navicula*, *Volvox*, *Oedogonium* and *Spirogyra* are commonly observed in freshwater fish culture pond of the Saurashtra region.

### IX. ANIMAL HEALTH & ANIMAL PRODUCTION

In animal health & production discipline, six non-plan, ten plan and one ICAR scheme includes 18 schemes are in operation at Cattle Breeding Farm, JAU, Junagadh. These schemes are aimed at genetic improvement in these bovines maintained at the farm and also in the field through supply of genetically superior bulls with breeding and improvement of Gir and Jaffarabadi bovines.

Strengthening of livestock inspectors

training centre and establishment of mobile ambulatory clinic at Cattle Breeding Farm. During the year, the training of 31 livestock inspectors has been completed at LITC. About 1616 dairy farmers and farm women visited this research station and 33 group night meeting were arranged. The centre has supplied 34 Gir bulls and six Jaffarabadi bulls to various *gram panchayats* and *gaushalas*. During the year, five experiments were conducted on genetic improvement, animal nutrients, animal production and health.

This group has released two farmers' recommendations which are briefed below.

#### Replacement of groundnut *gotar* with urea treated straw in composite feed blocks for Gir heifers

Farmers and livestock owners of Saurashtra are recommended that in the ration of Gir heifers, inclusion of four per cent urea treated wheat *bhusa* in place of groundnut *gotar* results in 19 per cent higher live weight gain at 23 per cent lower cost of feeding.

#### Milk production in Gir cows on no green rations

Feeding of 4 per cent urea treated wheat straw as sole roughage source to lactating Gir cows could sustain milk production up to 3.4 lts/day economically with 139 per cent higher returns compared to feeding *ad. Lib.*, wheat straw and five kg green jowar fodder/cow/day.

### X. BREEDER SEED PRODUCTION

The production of different breeder seeds to cater the need of private and public





sectors are given in the table. Moreover as per the demand of the Agriculture Department of the State, 100 per cent nucleus seed was produced in different crops by the joint

collaboration of the scientists of state and the country. The nucleus and breeder seeds were inspected by different committees which were approved as per regulations.

### Production of Nucleus / Breeder seed during year 2009-10

Sr. No.	Crop.	Variety	Production (Qtl.)		
			National	State	Total
1	Groundnut	GG-2	-	194.15	194.15
		GG-5	-	73.65	73.65
		GG-6	7.00	5.00	12.00
		GG-7	22.00	2.30	24.30
		GG-8	18.60	-	18.60
		GG-20	-	405.56	405.56
		GAUG-10	-	85.50	85.50
		GG-11	-	87.70	87.70
		GG-14	42.00	-	42.00
		GG-21	15.40	-	15.40
		GG-16	13.90	-	13.90
2	Pearl millet	Parent Seed	-	12.08	12.08
3	Chickpea	GG-1	-	44.58	44.58
		GG-2	2.39	25.14	27.53
		GG-3	-	72.87	72.87
		GG-4	13.40	-	13.40
4	Sesam	G.Til-2	2.00	12.05	14.05
		G.Til-3	-	6.96	6.96
		G.Til-10	0.10	0.30	0.40
5	Wheat	LOK-1	-	119.00	119.00
		GW-496	119.40	118.00	237.40
		GW-366	299.60	228.00	527.60
		GW-503	-	7.20	7.20
6	Cotton	Deviraj	-	0.43	0.43
7	Castor	GC-3	-	2.10	2.10
8	Cumin	Gujarat Cumin-4	-	2.50	2.50
		<b>Total</b>	<b>555.79</b>	<b>1505.07</b>	<b>2060.86</b>



**XII. MEGA SEED UNIT**

Established a Mega Seed Processing Plant in which 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 at their door steps.

**Production of truthful seed of different crops during year 2009-10**

Sr. No.	Crop	Production (Qtl.)
1	Groundnut	3152.44
2.	Pearl millet	6.30
3.	Chickpea	672.50
4.	Sesame	104.6
5.	Wheat	3605.00
6.	Cotton	99.60
7.	Castor	10.62
8.	Cumin	146.31
9.	Coriander	7.80
10.	Fenugreek	5.00
11.	Soybean	10.87
12.	Sunflower	6.90
13.	Mungbean	53.00
14.	Urdbean	43.28
15.	Pigeon pea	191.52
	<b>Total</b>	<b>8105.74</b>

**XII. NEW RESEARCH PROGRAMMES SANCTIONED DURING YEAR 2009-10**

Sr. No.	Agency	No. of Research Programmes	Amount (₹ in Lakhs)
1.	ICAR	03	295.42
2.	ICRISAT	02	39.32
3.	Other Agencies	19	101.32
4.	Govt. of Gujarat	01	3.42
5.	NAIP	01	44.37
6.	RKVY	05	448.08
	<b>Total</b>	<b>31</b>	<b>931.93</b>