

RESEARCH

4.1 Research Council

The Research Council has been constituted according to the Provision of the Gujarat Agricultural Universities Act-2004 in exercise of the power vested under Sec. No. 62(1) in pursuance of section 17(5).

4.2 Brief Report of Research Activities

The newly established Junagadh Agricultural University has 17 research stations. These research stations are working in the field of agriculture and animal science for the upliftment of rural people's life standard. At these research stations, scientists are putting their hard and sincere eco-friendly efforts for development of high yielding varieties of crops, new improved agronomical practices and pest & diseases management strategies. The research work is also undertaken on improvement of cattle breeds, nutritive cattle feeds and diseases management for the benefit of cattle owners. The scientists in the fisheries discipline are also working for upliftment of fishermen and fisheries industries in the state. Research activities and achievements of Junagadh Agricultural University during 2004-05 are given here under.

A. Plant Breeding

The seed multiplication programme was taken for Virginia runner, Virginia and Spanish bunch groundnut cultivars. In castor crop,

development of medium duration hybrids, male monoecious and pistillate lines was done. The male monoecious line JI-220 was registered as Fusarium wilt and Macrophomina root rot resistant source at NBPGR, New Delhi. Development of high yielding varieties and testing of vegetables new lines; early maturing with high yield and oil content varieties in sesame; development of rust resistant and breeding for thermo tolerant varieties of wheat suitable for early sowing are in progress. Seven national/international diseases screening nurseries were evaluated and genotypes were selected on the basis of rust resistance.



Four new varieties were recommended for cultivation to the farmers during 2004-05. The groundnut varieties released are GG-15(spreading) for Zone-IV (Tamil



Nadu, Andhra Pradesh, Karnataka, Kerala and South Maharashtra) and GG-21 (semi-spreading) for Zone-I (North Rajasthan, Punjab and Haryana) sown during *kharif* season. The hybrid GHB-538 *bajra* was released for *kharif* season cultivation in Gujarat, Rajasthan and Haryana. The sponge gourd variety Gujarat Sponge Gourd-1 was released and recommended for cultivation in the Gujarat state.

B. Agronomy and Soil Science

The scientists of agronomy and soil science disciplines have developed different cropping systems and crop production technologies, which are economically viable for main crops of different Agro-climatic Zones. The work include crop production techniques for improving salt affected soils, plastic mulching, drip irrigation, water and fertilizer saving, fertilizer and weed management, effect of micronutrients and suitable crops for erratic rainfall. Seventeen recommendations made for farmers during the year as mentioned here under.

1) Cropping Systems

Cotton

The farmers of North Saurashtra Agro-climatic Zone growing hybrid cotton (G.Cot.Hy-8) at the distance of 120 cm are advised to adopt intercropping with sesame (G. Til-2) or green gram (K-851) in the row ratio of 1:1 for getting higher yield and net return under dry farming condition.

Anjan grass

The farmers of North Saurashtra Agro-climatic Zone growing grasses are advised to use seed mixture of Anjan grass (2.66 kg/ha) and *Stylosanthes scabra* (1.66 kg/ha) for obtaining economical maximum green biomass and dry matter production on marginal lands under rainfed condition. Alternatively, instead of *Stylosanthes scabra*, *Clitoria* sp. (5 kg/ha) can also be used.

2) Cultural Practices

Cotton

The farmers of North Saurashtra Agro-climatic Zone (AES-15) growing cotton under rainfed condition are advised to sow cotton var. G.Cot.Hy.8 at row spacing of 120 cm for getting higher seed cotton yield and net return.

Sesame and Groundnut

The farmers of North Saurashtra Agro-climatic Zone growing sesame and groundnut crops in *kharif* season are advised to open the furrow after each three rows for sesame. The ridges and furrow method should be followed for groundnut crop at 20-30 days after sowing for obtaining maximum yield and net return.

Groundnut

The farmers of North Saurashtra Agro-climatic Zone growing groundnut in *kharif* are advised to adopt deep

ploughing every third year besides tractor harrowing every year to prepare the field for obtaining maximum yield and net return.

Onion

The farmers of coastal area of South Saurashtra Agro-climatic Zone growing *rabi* onion in saline soil with poor quality well water are advised to apply mulch (pearl millet husk) @ 5 t/ha during 15 to 20 days after planting in flat bed for getting higher net return.

3) Water Management

Sesame

The farmers of North Saurashtra Agro-climatic Zone growing sesame in *kharif* are advised to apply one irrigation at 50 per cent flowering during dry spell for getting maximum sesame yield and net return.

4) Bio-Fertilizer

Sorghum

The farmers of North Saurashtra Agro-climatic Zone growing sorghum as fodder crop in *kharif* are advised to choose sorghum variety GFS-5 and fertilized with 80 kg N/ha (40 kg as basal and 40 kg at 30 DAS) and *Azotobacter* and *Azospirillum* bio-fertilizer 5 packets/ha (each of 250 g) for getting maximum fodder yield.

Anjan grass

The farmers of North Saurashtra Agro-climatic Zone

growing Anjan grass in *kharif* season are advised to apply 20 kg N/ha (10 kg as basal and 10 kg at 30 DAS) along with *Azotobacter* 5 packets / ha (each of 250 g) for getting economically optimum green and dry matter yield in marginal lands under rainfed condition.

Groundnut and Wheat

The farmers of North Saurashtra Agro-climatic Zone adopting groundnut-wheat crop sequence are advised to apply 50 per cent recommended dose of fertilizer (6.25-12.5 kg NP/ha) + *Rhizobium* culture (250 g/10 kg seeds) + FYM 10 t/ha to groundnut and recommended dose of fertilizer (120-60-0 kg NPK/ha) to wheat for maximum yield and net return.

5) Nutrient Management

Bajra and Mustard

The farmers of North Saurashtra Agro-climatic Zone growing *bajra* (*kharif*)-mustard (*rabi*) crop sequence are advised to apply 100 per cent RDF + 10 t FYM/ha to *bajra* and only 50 per cent RDF to mustard crop to obtain higher yield and net return from *bajra* (*kharif*) mustard (*rabi*) crop sequence.

Sesame and Cotton

Farmers of North Saurashtra Agro-climatic Zone adopting sesame based intercropping system are advised to fertilize sesame +

Hy. cotton (3:1) with 100 per cent RDF of main and intercrop as per area for getting higher yield and net return.

Marvel grass

The farmers of North Saurashtra Agro-climatic Zone are advised to grow marvel grass with application of 60-30 NP kg/ha (30 kg N as a basal and 30 kg N at 30 DAS) for obtaining economically maximum green biomass and dry matter yield in marginal lands under rainfed condition.

Groundnut

The farmers of North Saurashtra Agro-climatic Zone growing groundnut (GG-20) under dry-farming condition in *kharif* season are advised to apply recommended dose of N and P through DAP and urea with gypsum (18.75 kg S/ha) for getting maximum pod yield and higher net return.

Garlic and Groundnut

The farmers of South Saurashtra Agro-climatic Zone adopting garlic-groundnut crop sequence in calcareous black soils having low Zn and medium to high K status are advised to apply 25 kg ZnSO₄ + 75 Kg K₂O per hectare in addition to recommended dose of N and P before sowing of garlic crop and recommended dose of N and P to *kharif* groundnut for getting higher yield and net return from garlic-groundnut crop sequence.

6) Weed Management

Sesame

The farmers of North Saurashtra Agro-climatic Zone growing sesame are advised to adopt two hand weeding at 15 and 30 days after sowing or one hand weeding at 15 days after sowing supplemented with one inter-culturing at 30 days after sowing. Under paucity of labourers, pre-emergence application of alachloar (1.5 kg/ha) or post emergence application of quizalofop ethyl (0.05 kg/ha at 15 DAS) supplemented with one interculturing at 30 days after sowing is recommended for efficient weed management, higher yield and better return.

Coriander

For effective and economical weed management in coriander crop, farmers of South Saurashtra Agro-climatic Zone are advised to follow hand weeding at 15, 30 and 45 days after sowing. Under paucity of labourers, they can apply trifluralin @ 0.75 kg/ha in 500 liters of water as pre-emergence or fluchloralin 0.6 kg/ha in 500 liters of water as pre-emergence + 1 HW at 30 days.

C. Horticulture

The trials on extending shelf life of mango, effect of manures and fertilizers on fruits bearing in sapota, evaluation of pruning treatment in

Cordia sp., varietal screening in custard apple and chrysanthemum and fertilizer management in drum sticks crop are in progress. Applications of chemical fertilizers through drip irrigation in guava and coconut were tried. The varietal screening, papain production in relation to fruit age, effect of organic and inorganic fertilizers and uniform fruits with extended shelf life trials in papaya crop were carried out. The studies on low cost green house, use of different nets in net house, leafy vegetables cultivation and coconut seedling raising in net house are progressing. The investigation on effect of mulching in coconut and sapota is also continued. One recommendation for farmers of Saurashtra region is made. Farmers of Saurashtra region are advised that the fresh fruits of custard apple and guava should be dipped in the solution of 0.5 per cent carbendazim for 10 minutes and then packing in polyethylene bag of 30 x 20 cm size having six vents with KMnO₄ coated silica gel for enhancing post harvest life, marketability and quality of fruits up to six days.

D. Plant Protection

The main objective of research work carried out by plant protection group is to develop the economically viable technologies for increasing production of agricultural commodities without harming the environment and livelihood of the people. During the year, 10 and 3 recommendations were made for farmers in entomology and plant pathology disciplines, respectively.

1) Agricultural Entomology

Chickpea

For the eco-friendly management of *Halicoverpa armigera* in chickpea in South Saurashtra Agro-climatic Zone, two spraying of *kadvi mehadi* leaf extract (ICBR 1:5.12) or *mamejva* leaf extract (ICBR 1:4.67) or *Jatropha* leaf extract (ICBR 1:4.41) or five per cent neem leaf extract (ICBR 1:4.12) or cartap hydrochloride 0.1 per cent (ICBR 1:1.93) at 15 days interval from the date of pest infestation is recommended.

Coriander

Integrated pest management module for coriander aphid comprising of sowing of coriander in 1st week of October and releasing coccinellid predators @ 400 adults/ha (ICBR 1:8.10) or IPM module comprising of sowing of coriander in 1st week of October and spray of endosulfan 0.07 per cent at ETL of 1.0 aphid index/plant (ICBR 1:5.00) is recommended for South Saurashtra Agro-climatic Zone.

Summer Okra

For the control of sucking pests (jassid and aphid) in summer okra, seed treatment of thiamethoxam @ 2.8 g/kg seeds (ICBR 1:12.28) or imidacloprid @ 5 g/kg seed (ICBR 1:11.51) is recommended for South Saurashtra Agro-climatic Zone.

Fenugreek

For the control of pest complex (jassids, thrips and leaf-miner) of fenugreek in South Saurashtra Agro-climatic Zone, two sprays of dimethoate 0.03 per cent (ICBR 1:7.97) or methyl-o-demeton 0.03 per cent (ICBR 1:5.68) at 15 days interval starting from pest infestation are recommended.

Pomegranate

For the control of fruit borer (*Virachola isocrates*) of pomegranate in South Saurashtra Agro-climatic Zone, two sprays of endosulfan 0.07 per cent or dichlorvos 0.05 per cent or monocrotophos 0.04 per cent or malathion 0.05 per cent at 15 days interval starting from pest infestation are recommended.

Groundnut

Farmers of North Saurashtra Agro-climatic Zone are advised to apply *karanj* cake (ICBR 1:6.86) or castor cake (ICBR 1:5.62) @ 250 kg/ha in furrow at the time of sowing for the management of pod borer (*Penthicoides seriatoporus* Fairmaire) in groundnut under dry farming condition.

Pigeon pea

Farmers of North Saurashtra Agro-climatic Zone are advised to adopt the bio-intensive module consisting of the first spray of HaNPV @ 250

LE/ha at ETL of 10 larvae/20 plants followed by second spray of *neem seed kernel* extract 5 per cent after 15 days of first spray (ICBR 1:1.95).

Farmers of North Saurashtra Agro-climatic Zone are recommended to adopt the insecticidal module consisting of the first spray of endosulfan 35 EC 0.07 per cent applied at ETL of 10 larvae/20 plants followed by second spray of monocrotophos 36 EC 0.036 per cent after 15 days of first spray (ICBR 1:7.97) for the management of pod borer (*Helicoverpa armigera*) and pod fly (*Melanagromyza obtusa*) in pigeon pea cultivated in dry farming areas.

Cotton

For the control of pink bollworm in cotton, farmers of Saurashtra region are advised to spray quinalphos 25 EC @ 500 g a.i./ha (ICBR 1:3.18) or spinosad 45 SC @ 50 g a.i./ha (ICBR 1:3.10) as and when pest crosses the ETL (10 male moths/pheromone trap/day).

For the management of insect pests of cotton, the following IPM strategies are recommended for farmers of South Saurashtra Agro-climatic Zone (ICBR 1:5.70).

1. Seed treatment with imidacloprid @ 10 g/kg seeds.
2. Collection of infested shoots of spotted bollworm in the early stage.

3. Installation of pheromone trap @ 5/ha one week after germination.
4. Early three releases of *Chrysoperla* @ 10,000 eggs or 1st instar larvae/ha.
5. Spraying of neem formulation (Azadirachtin 0.0035%) or NSKE 5 per cent.
6. Four times releases of *Trichogramma* @ 1.5 lakh/ha with the initiation of egg laying of the pest.
7. Spraying of HaNPV @ 450 LE/ha for *Helicoverpa armigera*.
8. Hand collection of eggs and larvae of *Helicoverpa armigera*.
9. Planting of maize as intercrop (10:1), marigold and castor as trap crops in and around the cotton field.
10. Need based application of insecticides for sucking pests and bollworms based on ETL.

Mustard

The farmers of South Saurashtra Agro-climatic Zone growing mustard crop are advised to apply first spray of insecticide cypermethrin + profenofos 44 EC 0.04 per cent (ICBR 1:9.65) or acephate 75 WP 0.05 per cent (ICBR 1:8.92) or imidacloprid 17.8 SL 0.005 per cent (ICBR 1:7.68) or methyl-o-demeton 25 EC 0.03 per cent (ICBR 1:5.92) or

carbosulfan 25 EC 0.03 per cent (ICBR 1:5.17) at appearance of aphids and second spray after 15 days of first spray.

2) Plant Pathology

Pearl millet

For the control of blast disease of pearl millet, two sprays of carbendazim 0.05 per cent (ICBR 1:3.85) at 15 days interval starting from the initiation of the disease are recommended.

Groundnut

Farmers of South Saurashtra Agro-climatic Zone are advised to use tebuconazole @ 1.25 g/kg as seed treatment (ICBR 1:51.12) to reduce the collar rot disease of groundnut.

Tomato

For the management of early blight of tomato in South Saurashtra Agro-climatic Zone, seed treatment with captan @ 3 g/kg seeds, application of carbofuran @ 1kg a.i./ha in seed bed and covering of nursery with nylon net (400 mesh) after sowing and after transplanting four sprays of mancozeb @ 0.3 per cent (ICBR 1:7.09) during *rabi* season at 15 days interval starting from initiation of early blight disease are recommended.

E. Agricultural Economics, Extension and Statistics

Agricultural economists worked on cost of cultivation and production of important crops, problems and performance of regulated market of Saurashtra region and economical analysis of contract farming in onion and relay cropping (groundnut + pigeon pea). Extension educationalists did an analysis of the training programmes organized by SSK, Junagadh. Statisticians studied on size and shape of plots for experimentation on black gram and sesame.

F. Agricultural Engineering

Agricultural Engineering is divided into four major disciplines i.e., Soil & Water Engineering, Agricultural Process Engineering, Farm Machinery & Power and Renewable Energy & Rural Engineering. In Soil & Water Engineering discipline, the main work carried out on watershed management technology in hot arid region, technology on skimming and recharging fresh water in saline ground water region, relationship for designing the small water harvesting structures, aquifer properties, sea water intrusion on the qualitative parameters of ground water, design and development of ground water recharge filter, evaluation of hydraulic of surge irrigation and development of dimensional analysis model for micro tube trickle irrigation system.

The major research works carried out in Agricultural Process Engineering Department were development of agro-processing

centre, design & development of cleaner-cum-grader for cumin, effect of different drying methods on seed quality of groundnut, storage and processing of custard apple, integrated pest management in coriander and products from groundnut, design & development of farm sapota grader, studies on peanut blended extruded products, gel extraction from *Aloe vera* leaves, studies on physico-chemical and biological changes during ripening of custard apple and forced air ventilated storage of onion.

In the Farm Machinery & Power discipline works carried out were design & development of tractor operated hay rake cum loader, modification and evaluation of agricultural residue shredder, status of farm mechanization in Saurashtra region, standardization of subsoiling technology using two bottom subsoiler, design and development of bullock drawn subsoiler, development and adoption of vertical conveying harvesting unit for mini tractor, development of tractor drawn groundnut digger cum shaker and groundnut pod exposure and development of bullock drawn pod exposure.

Works on development and performance evaluation of forced convection solar assisted dryer, energy evaluation of forced convection solar assisted drying of garlic and green house environmental energy management for cultivation were carried out in Renewable Energy & Rural Engineering discipline and sweep blade for interculturing is released for farmers.

Sweep blade for interculturing

Farmers of South Saurashtra Agro-climatic Zone growing row crops are advised to use sweep blade (angle 70° and working length 42 cm) for interculturing to reduce number of clogging and to improve weeding and field efficiency as compared to straight and curved blades. Use of sweep blade for interculturing also reduces drudgery to operator.



G. Fisheries Science

Survival and growth performance of mullet fish (*Mugil spp.*) using *Prosopis juliflora* pod powder incorporated feed, breeding/rearing technique of pearl oyster developed and seeds of pearl oyster produced studies were carried out. Three recommendations released for the fishermen for the year are as follows.

Breeding season of *Mugil seheli*

It is recommended to fishermen and scientific community that gravid female (length: 375 mm & above) and male (length: 341 mm & above) of *Mugil seheli* are available in coastal seawater of *Okha-mandal*

region during its major breeding season (late August to September) and minor breeding season (February). To maintain the population of *Mugil seheli* in coastal seawater of *Okha-Mandal* region, fishermen should not catch the fish during these periods.

Fish drying

For faster drying and better nutritional values of dried fish (particularly to get lower acid insoluble ash), drying of fish in solar dryer is advisable as compared to sun drying.

Oyster larvae feed

It is advisable to keep 25 ppt salinity water and 3000 lux of light intensity for getting speedy multiplication of cells of *Isochrysis galbana* - the live feed for Oyster larvae.

H. Animal Production and Health

In animal production and health discipline, 19 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 Jafrabadi bovines. Two recommendations were made for the farmers.

Animal Feed

Jowar straw and groundnut *gotar* in 70:30 ratio instead of *jowar straw* alone can meet the daily maintenance need of Gir bullocks.

Aforestation

Under rainfed agro-climatic situation of South Saurashtra, tree species *Azadirachta indica*, *Acacia nilotica*, *Ziziphus mauritiana* and *Tectona grandis* have fairly good survival and growth rate on barren, degraded and wasteland. Therefore, these tree species can be planted to conserve, afforest and improve such land.

I. Breeder Seed Production

The production of different breeder seeds for need of private and public sectors are given in the table. Moreover, as per the demand of the Agricultural Department of the State, 100 per cent nucleus seed was produced in the different crops. In collaboration of the scientists of state and the country, the nucleus and breeder seeds were inspected, which were approved as per regulations.

Nucleus / Breeder seed production during year 2004-05

Sr. No.	Crop	Variety	Production (Q)
1	Groundnut	GG-2	170.90
		GG-3	31.40
		GG-5	143.75
		GG-6	10.80
		GG-7	177.75
		SB-11	30.85
		GG-20	423.60
		GAUG-10	39.00
		GG-11	45.00
		GG-13	24.90
2	Gram	Gujarat-1	65.50
		Gujarat-2	26.25

3	Pearl millet	GHB-526	09.55
		GHB-558	15.00
4	Sesame	Gujarat-1	00.75
		Gujarat-2	05.70
		Gujarat-10	00.03
5	Cumin	Gujarat-4	04.28
6	Cotton	G.Cot.-21	02.80
		G.Cot.-10	01.65
7	Wheat	GW-496	60.80
		GW-503	08.80
		Lok-1	35.60
8	Soybean	Gujarat-1	02.01
		Gujarat-2	00.75
9	Sunflower	GS-1	00.50
		Modern	00.35
10	Pigeon pea		40.00
11	Green gram		15.00
12	Black gram		35.00
Total			1455.69

New research programmes sanctioned during 2004-05

Sr. No.	Agency	Research Programmes
1	Government of Gujarat	19
2	Government of India	02
3	ICAR	02
4	Other Agencies	10
Total		33