Department of Biochemistry
Post Graduate Institute
Mahatma Phule Krishi Vidyapeeth
Rahuri-413 722, Dist. Ahmednagar (MS)

Preamble

The subject of biochemistry was under sub-discipline in Agricultural Chemistry and Soil Science in most of Agricultural Universities in India until 1060s. However, with the rapid advancement in the science in general and plant biochemistry in particular, it soon became a voluminous body of knowledge with a dynamic character. The rapid advances in the areas of photosynthesis, respiration, nitrogen fixation, and nitrate assimilation, resistance to various biotic and abiotic stresses, nutritional, processing and storage properties of food grains, oilseeds, fruits, vegetables, animal and marine products and genetic manipulation of plants and farm animals at molecular level to improve the production and quality of agricultural produce and farm animals made it mandatory to establish an independent department of biochemistry in most of the Agricultural Universities in the country. Inspite of having four Agricultural Universities in the State, there was no separate Department for growth and development of this vital discipline in agriculture.On the recommendations of the Statutory Co-Ordination Committee Meeting of the Vice-Chancellors of the four Agricultural Universities and the Accreditation Team constituted by the Indian Council of Agricultural Research, New Delhi, a separate post-graduate Department of Biochemistry was approved and granted to this university in 1984 vide Govt of Maharashtra Resolution No. MPKV-1283/CR-233/20-A, dated 17 May, 1984. Subsequently an independent Department of Biochemistry was established and started functioning in this university from July 19, 1984.The Department started M.Sc.(Agri.) degree programme in 1984 with an intake capacity of nine students and a Ph.D. programme was started from 1998 with an intake capacity of two studentsto cater to the needs of public and private stake holders.

The following faculty headed this Department:

1. Dr. S. S. Kadam (1984-1987)
2. Dr. B. B. Desai (1987-1999)
3. Dr. J. K. Chavan (1999-2007)
4. Dr. S. V. Munjal (2007-2011)
5. Dr. R. M. Naik (2011- continuing)

The principal mandate of starting this department was to cater to the needs of the entire State in developing a skilled manpower in Biochemistry required for all the four Agricultural Universities of the State and the semi-government, public and private sector organizations. The objectives also included to undertake basic and applied biochemical research through Post-Graduate students and ad-hoc research projects pertaining to mechanisms of cytoplasmic male sterility and mitochondrial respiration in crop plants and interrelationships in vital biochemical and molecular processes of plant growth and productivity, genetic improvement

in crop plants, resistance to various stress conditions, composition and nutritional quality of foods, anti-nutritional and toxic factors in agricultural produce, and plant and human nutrition.

From the year 1984 and onwards a total of 166 M.Sc. and 8 Ph.D. students have been awarded degrees in Biochemistry. Most of them areemployed in various educational, public sector and private organizations *viz.*, Agricultural Universities, Agril. Schools, Jr. Science Colleges, MCVC Programme, State Govt. Civil Services including agriculture, police and forest departments, research organizations, municipal corporations and seed, fertilizer and irrigation agencies. Some are also working as scientists in various adhoc research projects.
The faculty has been awarded post doctoral fellowship like Common Wealth and Biotechnology Overseas Associateship. Since the inception of the Department in 1984, the academic staff has succeeded in obtaining financial assistance of over Rs. 50.78 lakhs through *adhoc* research projects funded by various agencies such as ICAR, and DST New Delhi, USDA etc. both in basic and applied areas.

The Department in collaboration with the Department of Agril. Chemistry and Soil Science of this University has organized and conducted a refresher training course on "Recent Advances in Soil, Plant and Water Research in Relation to Yield and Quality of Food Crops" w.e.f. 2.12.98 to 31.12.1998. Recently, on the eve of Golden Jubilee year celebration of this University the Indian society of Agricultural Biochemists, Kanpur and Department of Biochemistry, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, have jointly organized "Food and Nutritional Security Conclave" along with the XIV Convention of the Indian Society of Agricultural Biochemists at Mahatma Phule Krishi Vidyapeeth Rahuri-413 722 (MS), India, from February 25-27, 2019.

Faculty

S. N.	Name	Designation	Phone No.	Email
1.	Dr. R. M. Naik	Professor & Head	09423386451	rajeevnaik2@rediffmail.com
2.	Dr. P. K. Lokhande	Associate Professor	08275451596	pklokhande@gmail.com
3.	Dr. D. P. Kachare	Associate Professor	09421850110	dpkachare@rediffmail.com
4.	Dr. B. M. Bhalerao	Assistant Professor	09403847396	bharatbhalerao@gmail.com

Academic Programmes

A) M. Sc. (Agri.)
Capacity of students: 9
Year of start: 1984

B) Ph.D (Biochemistry)
Capacity of students: 2+2*
Year of start: 1998
(* in service candidate)

Course Layout

1. M. Sc. (Agri.)

Minimum Credit Requirements

Sr. No.	Subject	Minimum credit(s)
1.	Major	21
2.	Minor	09
3.	Supporting	05
4.	Seminar	01
5.	Research	20
	Total Credits	56
	Compulsory Non Credit Courses	06

Sr. No.	Course Number	Course Title	Credits
A) Major Subjects (Min. 21 credits)			
1	BIOCHEM 501	Basic Biochemistry	2+1=3
2	BIOCHEM 502	Intermediary Metabolism	3+0=3
3	BIOCHEM 503	Enzymology	2+1=3
4	BIOCHEM 504	Molecular Biology	2+1=3
5	BIOCHEM-505	Techniques in Biochemistry	1+2=3
6	BIOCHEM 507	Plant Biochemistry	3+0=3
7	BIOCHEM 510	Carbon And Nitrogen Metabolism	2+1=3
		Total	**15+6=21**
B) Minor Subjects (Min. 9 credits)			
1	MICRO 501	Microbial Genetics	2+1=3
2	FST 523	Neutraceuticals and Health Foods	2+1=3
3	PP 503	Physiological and Molecular Responses of Plants to Abiotic Stresses	2+1=3
		Total	6+3=9
C) Supporting Subjects (Min. 5 credits)			
1	STAT 511	Statistical Methods for Applied Sciences	2+1=3
2	MBB 508	Genomics and Proteomics	2+0=2
		Total	**4+1=5**
D) Seminar (01 credit)			
1	BIOCHEM 591	Master's Seminar	1+0=1
		Total	**1+0=1**
E) Master's Research (20 credits)			
1	BIOCHEM 599	Master's Research	0+20=20
F) Non Credit Compulsory Courses			
1	PGS 501	Library and Information Services	0+1=1
2	PGS 502	Technical Writing and Communication Skills	0+1=1
3	PGS 503	Intellectual Property and its Management in Agriculture	1+0=1
4	PGS 504	Basic Concepts in Laboratory Techniques	0+1=1

5	PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0=1
6	PGS 506	Disaster Management	1+0=1
		Total	**3+3=6**

2. Ph.D.

Minimum Credit Requirements

Sr. No.	Subject	Minimum credit(s)
1.	Major	16
2.	Minor	08
3.	Supporting	05
4.	Seminar	02
5.	Research	45
	Total Credits	75
	Compulsory Non Credit Courses*	06

*** exempted, if completed in Master's degree**

Sr. No.	Course Number	Course Title	Credits
D) Major subjects (Min. 16 credits)			
1	BIOCHEM 601	Advanced Enzymology	2+0=2
2	BIOCHEM 602	Advanced Molecular Biology	3+0=3
3	BIOCHEM 603	Biochemistry of Biotic and Abiotic Stresses	3+0=3
4	BIOCHEM 605	Genomics, Proteomics and Metabolomics	3+0=3
5	BIOCHEM 607	Advanced Techniques in Biochemistry	0+2=2
6	BIOCHEM 608	Biochemistry of Plant Hormones and Plant Pigments	2+1=3
		Total	**13+3=16**
E) Minor Subjects (Min. 8 credits)			
1	FST 611	Advances in Food Biotechnology	2+1=3
2	MICRO 602	Advanced Microbial Physiology	2+0=2
3	FST 624	Protein Chemistry and Technology	2+1=3
		Total	**6+2=8**
F) Supporting Subjects (Min. 5 credits)			
1	BIOCHEM 606	Biomembranes	2+0=2
2	PP 605	Climate Change and Crop Growth	2+0=2
3	BIOCHEM 604	Current Topics in Biochemistry	1+0=1
		Total	**5+0=5**

F) Seminar (2 credits)			
1	BIOCHEM 691	Doctoral Seminar-I	1+0=1
2	BIOCHEM 692	Doctoral Seminar-II	1+0=1
		Total	**2+0=2**
G) Doctoral Research (45 credits)			
1	BIOCHEM 699	Doctoral Research	0+45=45
F) Non Credit Compulsory Courses			
1	PGS 501	Library and Information Services	0+1=1
2	PGS 502	Technical Writing and Communication Skills	0+1=1
3	PGS 503	Intellectual Property and its Management In Agriculture	1+0=1
4	PGS 504	Basic Concepts in Laboratory Techniques	0+1=1
5	PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0=1
6	PGS 506	Disaster Management	1+0=1
		Total	**3+3=6**

Laboratories

A) Research Laboratory-I:

Sr. No.	Instrument / Equipment	Purpose
1	Shimadzu make UV-Visible spectrophotometer	To measure the absorbance of chromophoric solution
2	Kubota make high speed refrigerated centrifuge	To separate and extract biomolecules from analytes
3	YSI oxygen monitoring system	To moniter the oxygen level
4	Nano-drop Spectrophotometer	To measure the absorbance of nucleic acid
5	Gradient PCR	To amplify DNA by using specific primers
6	Agarose and PAGE electrophoresis units	To separate and characterize nucleic acids and proteins
7	Mili-Q- water purification system	To provide purified water for biochemical analysis
8	-20^{o}C deep freezer	To store the extracted nucleic acid, primers and chemicals

B) Research Laboratory-II:

Sr. No.	Instrument / Equipment	Purpose
1	Chemi-imulscence Gel documentation system	To capture the images of separated nucleic acids and proteins on Agarose and PAGE gels
2	High Performance Liquid Chromatography	To quantify the metabolites and active compounds
3	Gas Liquid Chromatography	To analyse the fatty acid profile and to assay nitrogenate activity

Research Laboratory-II

C) Teaching Laboratory

Sr. No.	Instrument / Equipment	Purpose
1.	Centrifuge machines	To separate biomolecules present in the analytes
2.	Spectrophotometer	To measure absorbance of chromphoric solution
3.	Digestion and distillation unit for nitrogen estimation	To estimate the protein content of grains and fodder
4.	pH meter	To measure pH of buffers
5.	Muffle furnence	To determine ash content of the sample
6.	Glass distillation unit	To prepare distilled water for biochemical analysis
7.	Ovan	To estimate the moisture content of the sample
8.	Hot plate	To reflux and heat the content while estimation of cellulose, hemiceelulose, lignin, ADF, NDF etc.

Projects Completed by Students

M. Sc. (Agri.) (Last two years)

Sr. No.	Name of M. Sc. (Agri.) Student	Name of Guide	Title of the M. Sc. (Agri.) Thesis	Year
1	D.V. Gate	Dr. S. V. Damame	Assessment of nutritional quality of forage F_1 Bajra x Napier hybrids	2017
2	A. M. Shaikh	Dr. R. M. Naik	Biochemical and molecular screening of safflower genotypes for drought and oil quality parameters	2017
3	Ms. S. B. Shinde	Dr. R. M. Naik	Identification of biochemical and molecular markers for screening pigeonpea (*Cajanuscajan* L.) genotypes against Fusarium wilt (*Fusarium udum*) resistance	2017
4	Ms. S. D. Jadhvar	Dr. A. A. Kale	Biochemical characterization against induced water stress in sugarcane	2017
5	C. L. Pote	Dr. A. A. Kale	Evaluation of changes in osmolytes, antioxidant enzyme activities and biochemical parameters in response to induced salinity stress in sugarcane	2017
6	R. A. Diware	Dr. S. V. Damame	Biochemical evaluation of lucerne genotype under drought stress	2017
7	Ms. P. U. Barve	Dr. U. S. Dalvi	Biochemical and molecular characterization of sweet sorghum varieties and hybrids grown in *kharif* season	2017
8	Ms. J. S. Sagbhor	Dr. P. K. Lokhande	Evaluation of antioxidative enzyme profile and polymorphism in chickpea parents and crosses exhibiting differences in root traits	2017
9	K. Ramkrishna	Dr. P. K. Lokhande	Effect of foliar application of salicylic acid and thiourea on wheat grown under drought stress	2018
10	D. D. Gaikwad	Dr. D. P. Kachare	Biochemical evaluation of groundnut genotypes for resistance against leaf spot disease	2018

11	Ms. J. K. Kharat	Dr. A. A. Kale	Polyamine effects on biochemical events in sugarcane grown under sodic soil	2018
12	V. R. Mane	Dr. R. M. Naik	Evaluation of molecular markers associated with high oleic acid trait in safflower (*Carthamustinctorius* L.).	2018
13	Ms. P. R. Mali	Dr. P. K. Lokhande	Evaluation of antimicrobial activity of medicinal plant extract against plant pathogenic microorganism." by	2018
14	G. B. Magar	Dr. P. K. Lokhande	Biochemical investigation of drought stress effect on reproductive development in chickpea	2018

Ph. D. (Biochemistry)

Sr. No.	Name of the Ph. D. student	Guide	Title of the Ph. D. Thesis	Year
1.	A. A. Kale	Dr. S. V. Munjal	Studies on some biochemical and molecular aspects of CMS in pearl millet	2002
2.	N. B. Ghokhale	Dr. J. K. Chavan	Biochemical and molecular analysis of pigeonpea in relation to wilt resistance	2003
3.	S. V. Damame	Dr. S. V. Munjal	Biochemical and molecular aspects governing drought tolerance in *Rabi* sorghum in comparison with existing stay-green genotypes.	2013
4.	P. K. Lokhande	Dr. R. M. Naik	Biochemical and molecular investigations of drought tolerance in chickpea genotypes exhibiting variability in root trait.	2015
5.	R. D. Satbhai	Dr. A. A. Kale	Biochemical and molecular studies in relation to heat shock response in wheat cultivars differing in thermotolerance.	2015
6.	B. R. Bhite	Dr. R. M. Naik	Investigation on the interplay of SPS, SUSY and invertase(s) in relation to sucrose accumulation in sugarcane**.**	2015
7.	U. S. Dalvi	Dr. R. M. Naik	Studies on unique /shared biochemical and molecular responses to biotic (*Fusarium* wilt) and abiotic (drought) stress in chickpea (*Cicer arietinum* L.)	2015
8.	S. C. Fattepurkar	Dr. R. M. Naik	Biochemical and molecular characterization of phytase from low phytate soybean (*Glycine max* (L.) Mirr.)	2017

Research Recommendations

Sr. No.	Research Recommendations	Joint Agresco held
1	In *kharif season harvesting of sweet* sorghum green canes at 45 days after 50% flowering is recommended for obtaining maximum juice, sugar content and ethanol yield.	Joint Agrosco, Dr. BSKKV, Dapoli, 2014
2	Sowing of sweet sorghum in second fort night of june is recommended for obtaining maximum juice, sugar content and ethanol yield.	Joint Agrosco, Dr. BSKKV, Dapoli, 2014
3	Comparative analysis of adaptative biochemical changes in wheat genotypes under Temperature Induction Tesponse (TIR) revealed, wheat genotype NIAW-917 to be thermo tolerant. This genotype can be used in wheat breeding programme for thermo Tolerance.	Joint Agrosco, Dr. BSKKV, Dapoli-2014
4	The biochemical analysis of chickpea genotypes under osmotic stress clearly revealed significant variation in lipid peroxidation rates and ascorbate peroxidases (APX) activity which could be used for screening of chickpea genotypes for the drought tolerance ability.	Joint Agrosco, Dr. BSKKV, Dapoli, 2014
5	Drought induced profile and activities of ROS scavenging enzymes were higher in chickpea variety Vijay and in the crosses involving Vijay as a male parent. It is recommended to use Vijay as a genetic resource in chickpea breeding programme for improving drought tolerance of elite chickpea genotypes.	Joint Agrosco, MPKV, Rahuri-2015
6	The use of three ensymes (phenylalanie ammonia lyase, chitinase and β-1,3-glucanase) and SSR primer NKS11 is recommended for rapid screening of sugarcane clones for smut resistant.	Joint Agrosco, MPKV, Rahuri-2015
7	Pigeon pea genotypes can be rapidly and reliably screened for *Fusarium wilt* resistance by analyzing the levels of OD phenols, activity profile of β-1-3- glucanase and amplification of genomic DNA with RAPD OPG-08, SCAR-1 and ASSR-1 primers.	Joint Agrosco, Dr. BSKKV, Dapoli-2018

Extension Activities

The staff members have actively participated in shetakarimelawas, agricultural exhibitions, training to SMS and other extension workers including women. The faculty of this Department actively involved in the action plan workshop for KVKs. Several popular articles in marathi in leading new papers and agricultural periodicals have been published. The radio talks (20) and television programme related to nutritional quality of food grains and their products, processing and storage of cereals, legumes, oilseeds, fruits and vegetables have been broadcasted. One of the marathi publication "VridhiSamprerake (Growth Regulators) from this department has received a Best Agricultural Literature Award from Govt. of Maharashtra for 1996-97.

The Department in collaboration with the Department of Agril. Chemistry and Soil Science of this University organized has conducted a refreshers training course on "Recent Advances in Soil, Plant and Water Research in Relation to Yield and Quality of Food Crops"

w.e.f. 2.12.98 to 31.12.1998. Recently, on the eve of Golden Jubilee year celebration of this University the Indian society of Agricultural Biochemists, Kanpur and Department of Biochemistry, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, have jointly organizing "Food and Nutritional Security Conclave" along with the XIV Convention of the Indian Society of Agricultural Biochemists at Mahatma Phule Krishi Vidyapeeth Rahuri-413 722 (MS), India, from February 25-27, 2019.

Research Publications

A. Books

Salunkhe, D.K., Chavan, J.K. and Jadhav, S.J. 1984**. Nutritional and Processing Quality of Sorghum**. Oxford & IBH Pub. Co, New Delhi. pp. 275.

Salunkhe, D.K., Chavan, J.K. and Kadam, S.S. 1985. **Postharvest Biotechnology of Cereals.** CRC press Inc. Boca Raton, FL. USA. pp. 208.

Salunkhe, D.K., Kadam, S.S. and Chavan, J.K. 1985. **Postharvest Biotechnology of Food Legumes**. CRC Press Inc. Boca Raton, FL. USA. pp. 160.

Salunkhe, D.K. and Kadam, S.S. 1989. **Handbook of World Food Legumes: Nutritional Chemistry, Processing Technology, and Utilization**, Vol. I, II, & III, CRC Press, Inc.

Salunkhe, D.K., Chavan, J.K., and Kadam, S.S. 1990. **Dietary tannins : Consequences and Remedies**,CRC Press Inc. Boca Raton, FL. U.S.S. pp. 240.

Salunkhe, D.K., Chavan, J.K., Adsule, R.N. and Kadam, S.S. 1992. **World Oilseeds** : **Chemistry Technology and Utilization**, Van Nostrand Reinhold, New York, pp.544.

Desai, B.B. and Chavan, U.D. Growth Regulators, **A New Revolution in Agriculture** (Book in Marathi), UtkarshaPrakashan, Pune, 1996.

Desai, B.B., Kotecha, P.M. and Salunkhe, D.K. 1997. **Seeds Handbook**. Marcel Dekker, Inc., New York, pp. 627.

Desai, B.B., Kotecha, P.M. and Salunkhe,D.K. 1999**. Science and Technology of Groundnut**, NayaProkash, Calcutta, p. 677.

Desai, B.B., **Handbook of Nutrition and Diet**, Marcel Dekker, New York (In Press).

B.Research Papers Published in National and International Journals

Research Publications

Kadam, N.D., Patil, G.D., Chougule, B.A. and Kadam, S.S. 1987. Effects of foliar application of Vipul on yield, soluble proteins, total protein and nitrate reductase activity in spinach. India J. Plant Physiol. 41:123.

Chavan, J.K. and Nagarkar, V.D. 1988. Nutritional and *bhakari* making qualities of some improved cultivars of grain sorghum. *J. Mah. Agril. Univ.* 13:198.

Kachare, D.P., Chavan, J.K. and Kadam, S.S. 1888. Nutritional quality of some improved cultivars of cowpea. *Qual. Plant. Plant Fds. Hum. Nutr.* 38:155.

Babar, V.S., Chavan, J.K. and Kadam, S.S. 1988. Effects of heat treatments and germination on trypsin inhibitor activity and polyphenols in jack bean (*Canavalia ensiformis* L.). *Qual. Plant PlantFds. Hum. Nutr.* 38:319.

Chavan, U.D., Chavan, J.K. and Kadam, S.S. 1988. Effects of fermentation on soluble proteins and *in vitro* protein digestibility of sorghum, green gram and sorghum-green gram blends. *J. Fd. Sci.* 53:1574.

Bhise, V.J., Chavan, J.K. and Kadam, S.S. 1988. Effects of malting on proximate composition and*in vitro* protein and starch digestibilities of grain sorghums. *J. Fd. Sci. Technol.* 25:325.

Munjal, S.V., Desai, B.B., Ugale, S.D., Daftardar, S.Y., Bapat, D.R. and Naik, M.S.1988a. Carbon monoxide sensitivity of cytochrome c oxidase in male sterile seedlings of pearl millet, *Phytochemistry* 27:1955.

Munjal, S.V., Desai, B.B., Daftardar, S.Y., Bapat, D.R. and Naik, M.S. 1988b. Carbon monoxide sensitivity of cytochrome c oxidase in male sterile seedlings of sorghum. *Phytochemistry*27:3367.

Naik, M.S., Munjal, S.V. and Desai, B.B. 1988. Regulation of light and dark assimilation of nitrate in plants. *ISI Atlas of Science : Animal and Plant Sciences* 1:275.

Beldar, D.R., Chavan, J.K., Deshmukh, R.B. and Kadam, S.S. 1989. Nutritional analysis of promising germplasm of black gram and green gram. *J. Mah. Agril. Univ*. 14:47.

Chavan, J.K., Kachare, D.P. and Kadam, S.S. 1989. Influence of sprouting on nutritional quality of sorghum. *J. Mah. Agril. Univ*. 14:246.

Chavan, J.K., Chavan, U.D. and Nagarkar, V.D. 1989. Effects of malting and fermentation on nutritional quality of sorghum. *J. Mah. Agril. Univ*. 1989. 14:246.

Kadam, N.D., Patil, G.D., Chougule, B.A. and Kadam, S.S. 1989. Effects of foliar application of Vipul on chlorophyll content, active iron, catalase, peroxidase and polyphenol oxidase activities in spinach, *Indian J. Pl. Physiol.* 31:434.

Damame, S.V., Chavan, J.K. and Kadam, S.S. 1990. Effects of roasting and storage on protein and oil quality of peanut. *Qual. Plant PlantFds. Hum. Nutr*.40:143.

Chavan, J.K., Shinde, V.S. and Kadam, S.S. 1990. Utilization of expeller pressed partiallydefatted peanut cake meal in the preparation of bakery products. *Plant Fds. Hum. Nutr*. 41:253.

Tate, P.V., Chavan, J.K. and Kadam, S.S. 1990. Processing of commercial peanut cake into food grade meal and its utilization in preparation of cookies, *Plant Fds. Hum. Nutr*. 40:115.

Shinde, G.B., Adsule, R.N. and Kale, A.A. 1990. Distribution of phytate phosphorus, polyphenols and trypsin inhibitor activity in different seed parts of cowpea (*Vignaunguiculata* L. Walp.) *Bulletin of Grain Technology*, 28:238.

Chavan, U.D. and Chavan, J.K. 1991. Utilization of malted sorghum, mung bean and black gram in preparation of *bhakari*. *J. Mah. Aril. Univ*. 16:141.

Chavan, U.D., Chavan, J.K. Pinjari, M.B. and Kadam, S.S. 1991. Nutritional quality of promising groundnut cultivars. *J. Mah. Agril. Univ*. 16:48.

Chavan, U.D., Chavan, J.K. and Kadam, S.S. 1991. Preparation and storage behaviour of salted groundnut. Bev. Fd. World. 18:21.

Suryawanshi, J.R., Adsule, R.N. and Chavan, U.D. (1991). Effect of heat processing and storage on nutritional composition of groundnut kernels. *J. Maharashtra Agric. Univ.*, 16 (2) : 213.

Chavan, U.D., Adsule, R.N. and Kachare, D.P. (1991). Chemical composition and nutritional quality of some promising cultivars of okra. J. Maharashtra Agric. Univ.,16 (2) : 287-288.

Munjal, S.V. and Desai, B.B. 1991. Mitochondrial origin of reductant (NADH) for *in vivo* nitrate reductase in winged beanleaves. *J. Maharashtra agric. Univ*. 16:186.

Naik, R.M. Munjal, S.V., Singh, P. Desai, B.B.Mehta S.L. and Naik, M.S. 1991. Dissociation of cytochrome oxidase carbon monoxide complex incomplete darkness. *Phytochemistry*. 30:1061.

Kale, A.A., Gadakh, S.R. and Adsule, R.N. 1991. Physico-chemical characteristics of six improved varieties of bittergourd. *Maharashtra J.Hort*. 5:56.

Shinde, G.B., Adsule, R.N. and Kale, A.A. 1991. Changes in phytate phosphorus, polyphenols and trypsin inhibitor activity during soaking and germination of cowpea seeds. *Indian J. Agril.Biochemistry*, 1:31.

Shinde, G.B., Adsule, R.N. and Kale, A.A. 1991. Changes in phytate phosphorus, polyphenols and trypsin inhibitor activity during soaking and germination of cowpea seeds. *Indian J. Agril. Biochemistry,* 1:31.

Patil, P.B., Adsule, R.N. and Naik, R.M. 1991. Changes in physico-chemical characteristics ofgrape berries during development. *Maharashtra J. Hort*. 3:1.

Patil, P.B., Adsule, R.N. and Naik, R.M. 1991. Changes in reducing sugars, total phenols, anthocyanins and polyphenol oxidase activity in developing grape berriesof thompson seedless, Chimasahebi and Anab-E-Shahi varieties. M*aharashtra J. Hort* 5:5.

Kachare, D.P., Chavan, J.K. and Kadam, S.S. 1992. Influence of storage on quality of oil from some commercial groundnut cultivars. *J. Mah. Agril. Univ*. 17:167.

Chavan, U.D. and Chavan, J.K. 1992. Utilization of groundnut flour in preparation of sorghumbhakari. *J. Mah. Agril. Univ*. 17:346.

Naik, R.M., Dhage, A.R., Munjal, S.V., Singh, P. Desai, B.B., Mehta, S.L. and Naik, M.S. 1992. Differential carbon monoxide sensitivity of Cytochrome *c* oxidase in the leaves of C_3 and C_4 plants. *Plant Physiology* 98:984.

Dhage, A.R., Desai, B.B., Naik, R.M. and Munjal, S.V. 1992. Carbon monoxide sensitivity of cytochrome c oxidase of rice (*Oryza sativa* L.) cultivars. *Indian J. Exp. Biol*. 30:421.

Dhage A.R., Desai, B.B., Naik, R.M., Munjal, S.V. and Naik, M.S. 1992. Modification of the redox state of cytochrome *c* oxidase of rice due to certain stress treatments. *Indian J. Biochem. Biophys*. 29:425.

Kale, A.A., Adsule, R.N. and Kadam, S.S. 1992. Changes in chemical composition of sunflower (*Helianthus annuus* L.) seed during maturation. *Ind. J. Agric. Chem*. 25:143.

Patil, P.B., Desai, B.B., Chavan, U.D. and Naik, R.M. 1992. Proximate composition and protein fractions of some promising sorghum cultivars. *J. Mah. Agric. Univ*. 17:307.

Kachare D.P. and Chavan J.K. 1992. Effect of seed treatment on the changes in fat acidity of pearl millet meal during storage. Indian J. agric. Biochem. 5:15-24.

Patil, U.G., Chavan, J.K., Kadam, S.S. and Salunkhe, D.K. 1993. Effects of dry heat treatments to peanut kernels on the functional properties of the defatted meal. *Plant Fds. Hum. Nutr.* 17:346.

Kachare, D.P., Chavan, J.K., Chavan, U.D. and Kadam, S.S. 1993. Effects of storage on chemicalchanges in palm, groundnut and cotton seed oil and their blends. *Beverage and Food World*.20:16.

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Adhoc Projects (completed)

Sr. No.	Title of Project	Sponsoring Agency & Duration	Grants (Rs.)
	Basic Research Area		
1	Monitoring genetic differences in crop plants by examining CO-sensitivity of cytochrome *c* oxidase	ICAR, New Delhi, 1985-1987	4,01,800
2	Biochemical & molecular mechanisms regulating CO- sensitivity of cytochrome c oxidase in crop plants	DST, New Delhi, 1993-1999	5,25,170
3	Role of mitochondrial respiration, photorespiration and nitrogen assimilation in dry matter production and productivity of crop plants	ICAR, New Delhi, 1997-2000	9,45,680
4	Genomic analysis of mitochondria involved in cytoplasmic male sterility (CMS) in pearl millet (*Pennisetumglaucum*L.)	DST, New Delhi, 1998-2001	13,18,405
	Applied Research Area		
5	Malting and fermentation of sorghum and legumes for improving their nutritional and *bhakari* quality	ICAR, New Delhi, 1985-87	1,58,000
6	Influence of processing and storage on nutritional composition and shelf-life of groundnut and its products	(PL-480) USDA, 1987-1989	5,60,000
7	Improvement in the shelf-life of pearl millet meal	ICAR, New Delhi, 1997-2000	2,47,800
8	Pearling of black sorghum by physico-chemical methods and its utilization.	ICAR, New Delhi, 1997-2000	6,27,483
9	Production of mucilage from okra cortex	ICAR, New Delhi, 1999-2002	4,40,000
		Total (Rs.)	**50,78,845/-**

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