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STANDARD FORMAT OF THESIS AND SYNOPSIS FOR PG RESEARCH

INSTRUCTIVE MANUAL
Course: PGS 502

TECHNICAL WRITING AND
COMMUNICATIONS SKILLS

COMPILER :-

Dr. S. N. Saravaiya, I/c Professor
Department of Vegetable Science
ASPEE College of Horticulture and Forestry
Navsari Agricultural University, Navsari

November 2020

Dr. S. R. Chaudhary
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Message

The Navsari Agricultural University is catering the need of the state as well as nation in terms of education, research and extension. The university offers graduate, post graduate and doctoral degree programme under various faculties. Under the post graduate and doctoral programme, along with the course work, it is mandatory for the PG student to carry out a research project and prepare a synopsis and thesis for the award of degree. In spite of their tremendous potential and enthusiasm, these scientists, starting as graduate students, are measured primarily not by their dexterity in laboratory manipulations, not by their innate knowledge of either broad or narrow scientific subjects, and certainly not by their wit or charm; they are measured, and become known (or remain unknown) by their publications.

The goal of scientific research is publication. A scientific experiment, no matter how spectacular the results, is not completed until the results are published. In fact, the cornerstone of the philosophy of science is based on the fundamental assumption that original research must be published; only thus can new scientific knowledge be authenticated and then added to the existing database that we call scientific knowledge.

Therefore, these post graduate students are being taught a pre-requisite (NCC) course "Technical Writing and Communications Skills" (PGS-502 0+1) to develop the skills for conducting research and preparing a manuscript for thesis and scientific publication.

I am happy to note that Dr. Sanmukh N. Saravaiya, Professor and Head, Department of Vegetable Science, ASPEE College of Horticulture & Forestry, NAU, Navsari has come up with present publication entitled "Standard Format of Thesis and Synopsis for PG Research" for our post graduate students. I hope that this will provide necessary guidelines to the PG students of NAU, Navsari.

I congratulate him for his present endeavour.

Date: 10/11/2020



(S. R. Chaudhary)

Dr. P. K. Shrivastava

Dean

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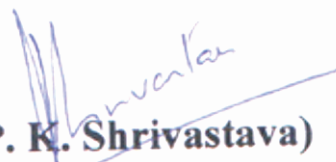


Preface

The scientific and technical writing is an art and require tremendous skill and patience. The research scientists are perhaps unique among the trades and professions, who must provide a written document showing what he or she did, why it was done, how it was done and what were the lesson learnt. The key word is reproducibility which makes science and scientific writing unique. Thus, the scientist must not only “do” science but must “write” science. Bad writing can and often does prevent or delay the publication of good science. The students admitted to the post graduate and doctoral programme in NAU, not only have to go through the exhaustive course work, but also have to conduct a research and submit a Synopsis and thesis for the award of degree. Therefore, being the future scientists, these students need thorough knowledge about the research methodology and preparation of manuscript of synopsis thesis and research papers. In ASPEE College of Horticulture and Forestry these essential elements are being taught to the students under the course entitled “Technical Writing and Communications skills” (PGS-502) as a pre-requisite, by Dr. Sanmukh N. Saravaiya, Professor and Head, Department of Vegetable Science, ASPEE College of Horticulture & Forestry, NAU Navsari taught this course from the year 2014 to 2016, which inspired him to come up with this useful publication.

I hope that the present publication prepared by Dr. Sanmukh N. Saravaiya will prove beneficial to the post graduate students and shall be helpful to them for preparation of manuscript in synopsis, thesis and technical papers for publication.

I congratulate him for his valuable publication.


(P. K. Shrivastava)

Date: 10/11/2020

Acknowledgement

It gives me an immense pleasure to put the present publication for the post graduate students of Navsari Agricultural University, Navsari. The scientific and technical writing is an art and requires lot of practice. After joining post graduation the students face great difficulties not only during planning experiments / research work but also while writing their synopsis and thesis to fulfill the basic requirements of their post graduate programme. Though huge literature is available on scientific writing, the information on different aspects of technical writing is scattered. During the past so many years of teaching the course on technical writing (STW 501 as per 3rd Deans' Committee and PGS 502 as per 4th Deans' Committee recommendation), I felt that the PG students must be provided a ready to use material as guidelines which shall be helpful during their post graduate programme. The present publication consists of the course material as per the 4th Deans' committee recommendation. The publication also contains the format of synopsis and thesis along with the required certificates as per the norms set out by the Dean P.G. Studies, Navsari Agricultural University for submission of thesis/ synopsis.

I take the opportunity to thank Dr. S. R. Chaudhary, the Dean P.G. Studies, NAU, Navsari who inspired me to bring out the present publication. I am also thankful to Dr. P. K. Shrivastava, Dean, ASPEE College of Horticulture & Forestry, Navsari Agricultural University, Navsari for their constant encouragement, support and to provide financial assistance from B.H. 12237 to bring out this publication.

I am extremely thankful to Dr. R. P. Gunaga and Dr. Y. N. Tandel, Associate Professor as well as Dr. D. T. Chaudhari and Dr. B. N. Chaudhari Assistant Professor of this college for providing necessary guidance for preparing this manuscript. I am also thankful to Dr. Satish B. Deshpande, Kamdhenu University, Gandhinagar for providing me necessary material for teaching the PG students and justify this course.

The critics and suggestions for further improvement are welcomed.



(S.N.Saravaiya)

Date: 10/11/2020

Dr. S. N. Saravaiya

Professor

Department of Vegetable Science

ASPEE College of Horticulture & Forestry

Navsari Agricultural University

Navsari-396 450

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**Compiler Bio data**

Dr. Sanmukh N. Saravaiya, is serving as I/c Professor, Department of Vegetable Science at ASPEE College of Horticulture and Forestry of Navsari Agricultural University, Navsari, Gujarat, India has a brilliant career throughout and has professional experience of more than 31 years. He joined GAU, Navsari Campus, Navsari as Senior Research Assistant in 1989. Prior to joining GAU, he served as Assistant Professor for 4 years in BRS College at Vedchhi and Grambharati. He obtained degree of B.Sc. (Agri.) and M.Sc. (Agri.) in Horticulture with first class from GAU, Sardarkrishinagar in 1982 and 1984, respectively. He got Ph.D. degree in Horticulture (2005) from Navsari Agricultural University, Navsari under the technical guidance of Dr. B. M. Patel, Retd. Dean and Principal of ASPEE College of Horticulture and Forestry, NAU, Navsari securing first class distinction. He worked in the different capacities. He has played an anchor role for 'Eco-friendly and cost effective management strategy of Slug in okra' for which he deserved to achieve Prof. J. P. Trivedi Award, sponsored by Shri Hari Om Ashram, Nadiad in the year 2003, through 'GAAS'. He was the recipient of Best Teacher Award sponsored by ICAR, New Delhi in the faculty of Horticulture on 15-1-2015. His Ph. D. student Patel Himani Biharilal, Reg. No. 1020215011 got best Ph.D. thesis award for securing the Highest Overall Grade Point Average and rating of the thesis in the subject of Vegetable Science for the degree of Ph. D. He received 7 Uttam Lekh Award of Krushi Govidya from Vice Chancellor, AAU, Anand. He has qualified at National Eligibility Test, (NET) held in June-2004 by ASRB, (ICAR), New Delhi in the professional subject of Vegetable Science. His main area of interest is Olericulture. He has attended International/Global Seminar (4), Seminar (49), Workshop (11), Short-courses (3), Summer/Winter School (3), Symposium (3) and Orientation Programme (1).

He is a member of editorial board of Asian Journal of Horticulture, Muzaffarnagar (U.P.) as well as Chief Editor of Gujarat Journal of Applied Horticulture, publish by the Horticultural Society of Gujarat. He has to his credit a number of research papers and review articles (92), Research Paper Presented: In National Seminar/Symposium (34), Research Paper (Poster) Presented: In International Seminar/Symposium/Global Conference (35), Research Paper

(Poster) Presented: In National Seminar (20), Research Paper Presented: In National Webinar (1), books (21), booklets in Gujarati (12), booklets in English (2), Popular Articles in Gujarati (334), Popular Articles in English (13), Popular Articles in Hindi (1), press notes (32), folders (42), TV telecast (17), radio talk (1), practical manual (11) and development of high yielding turmeric variety (GN Turmeric -1), little gourd variety (GNLG-1), pointed gourd variety (GNPG-1), tomato (GT-7), brinjal variety (GNRB-1), sweet potato variety (Bhu Kanti) and Greater yam variety (GGY-1: Hemlata), Contribution in evaluation of variety at different SAUs of Gujarat (9). He has contributed in 34 farmer's recommendation. He delivered lectured in Winter School /International Conference (9). He has his credit of 7 chapters in different books, 1 Chapter in Special Publication and 1 Chapter in Training Manual. He is a member of 9 scientific societies and 5 academic bodies. He was actively associated with the five projects of Jeevika as well as AICRP (VC) and several other research and development work. He has also presented various research papers in state and national level seminars as well. His current priorities including technical guidance as Major Guide to M.Sc. students in the subject of M.Sc. (Horticulture) Vegetable Science and Ph.D. Student registered in the subject of Ph.D. (Horticulture) Vegetable Science, besides teaching to the U.G. and P.G. level. He has guided 14 students of M.Sc. (Horticulture) Vegetable Science and 5 students of Ph.D. He has been worked as P. G. Seminar Co-ordinator of ASPEE College of Horticulture, NAU, Navsari for 8 years. He is also regularly conducting JRF/SRF/NET coaching classes since last 5 years as Co-ordinator. He has also a life membership of various journals and magazines. He has successfully arranged a 3 days national seminar on Technologies and Sustainability of Protected Cultivation for Hi-Valued Vegetable Crops" during February 01-03, 2018 at ACHF, NAU, Navsari as co-chairman. He has prepared and presented Standard Format of Thesis and Synopsis for PG Research of NAU, Navsari in 42nd AC meeting of NAU, Navsari and it was approved.

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THESIS FORMAT FOR PG RESEARCH NAU

COMMON GUIDELINES

Research work execute during the course of master/doctoral study is one of the most significant accomplishment of the post-graduate students and that to be documented and submitted in the form of a thesis to the university. The thesis is most vital document for the students and for the academics as the thesis is referred by large number of people involved in the teaching, research, extension and developmental activities. Therefore, it is necessary that the students and the advisory committees make well organized hard work to reveal the quality research work and to present the thesis in a form which is nationally and internationally acceptable.

For this, there should be standardization in the preparation of thesis across various faculties of the university. Hence, the following guidelines to be implemented by the students and the advisory committees to prepare and submit quality thesis. These guidelines are to be followed carefully. In case of any deviation, the thesis shall be returned to the student for resubmission after necessary revision.

GUIDELINES

The guidelines deal with the presentation of a thesis and similar documents which fall within the definition of the term “Thesis”.

Definition:

For the purpose of these guidelines, a thesis or a dissertation is a statement of investigation or research presenting the author’s findings and any conclusions reached, submitted by the author in support of his/her candidature for a higher degree, professional qualification or other award.

Ph.D. thesis must demonstrate the originality and ability of the student for an independent investigation and the results of the research must constitute a contribution to knowledge. The thesis must exhibit the students’ mastery over the literature on the subject and familiarity with its sources.

M.Sc. thesis must demonstrate the student’s familiarity with the tools of research, scholarly analysis in their major field and ability to present the results of their investigation effectively.

Copyright:

The University shall reserve the right to make available or to allow the thesis to be copied in whole or in part without any reference to the author for study and

reference purposes subject to normal conditions of acknowledgement. In all other cases, the copyright rests with the author.

Publication of the Thesis:


Whenever any materials from the thesis are used for preparation of manuscript, it is mandatory to quote thesis as “It is a part of M.Sc. / Ph.D. thesis submitted to the Navsari Agricultural University, Navsari” in the acknowledgement.

All other details including format are given in Appendix-A to C, along with certificates/undertaking.

APPENDIX- A

-: GUIDELINES FOR THESIS FORMAT:-

- A. Preliminary pages
- B. Text: Chapter 1 to 5
- C. End matter: References and Appendices, Certificate

University Emblem	Mandatory on front Cover page and Title Page  Navsari Agricultural University 2.5 cm height × 5 cm width		
Title of thesis	Concise (short) and precise (accurate)		
Paper	8.27 inch × 11.69 inch or 21.0 cm × 29.7 cm. (A4 Size), Minimum 80 gsm, Acid free white bond paper		
Page margin & layout	Left: 1.5” (3.81 cm) Right: 1” (2.54 cm) Portrait Top:1” (2.54 cm) Bottom: 1” (2.54 cm)		
Header & Footer	0.5 inch (1.27 cm)		
Line Spacing	Text :1.5 space Abstract: 1 space Acknowledgement: 1 space		
Printing	On both sides of the sheet New CHAPTER should start from new odd page		
Font type & colour	Times New Roman, pure Black		
Font size	Chapter heading: First level heading Centre align CHAPTER 1		
	All CAPS CHAPTER 1	16 point	Bold
	Chapter title : Centre align, 1.5 Space below the chapter heading: INTRODUCTION	14 point	Bold
	Topic heading – Left align		
	All CAPS	12 point	Bold
	Sub topic heading – Left align		
	First letter of each word capital	12 point	Bold
	Sub sub topic heading – Left align		

	First letter of topic is capital	12 point	Bold
	Regular Text Justify align		
		12 point	Normal
Sequence of Preliminary Pages and Numbering	Sequence : Title Page Abstract Certificate-I Declaration Acknowledgment Contents List of Tables List of Figures List of Photographs List of Symbols and Abbreviations (No need to mention common symbols and abbreviations) References Appendices Certificate-II	Numbering : At footer, Centre Align Times New Roman 12 point Bold Lower case Roman Numeral (i, ii, iii.....)	
Abstract	Maximum two pages (Line spacing 1)		
Acknowledgement	Maximum two pages (Line spacing 1)		
Table No. and table title	Chapter vice, Arabic numerals, At the top, without full stop. It must match with the list of tables		
Figure No. and figure title	At the bottom, below the figure, Chapter vice, without full stop, it must match with the list of figures		
Photographs	Relevant photographs can be added at appropriate places		
Text & end matter	INTRODUCTION, REVIEW OF LITERATURE, MATERIALS AND METHODS, RESULTS AND DISCUSSION, SUMMARY AND CONCLUSIONS, REFERENCES, APPENDICES, CERTIFICATE -II		

Sequence of text and numbering	Sequence : All chapters begin with the ODD new page of the regular text in the thesis <i>i.e.</i> CHAPTER 1), all pages should be continuously numbered	Numbering : At footer, centre align Times New Roman 12 point, Bold Arabic Numerals (1,2,3,4...)
	REFERENCES, APPENDICES and CERTIFICATE - II	Roman Numerals (i,ii, iii, iv...)
Numbering sequences in chapter: (Theoretical orientation)	1 1.1 1.1.1 1.1.1.1 (Not more than four level)	
No . of copies (<i>Pakka</i> bound Thesis)	4 hard and soft copies (Major guide, Student, Department & University Library) + 1 for financial agency if any <i>e.g.</i> ASPEE like organization	
Binding colour	Master's : Navy blue with silver letters and silver corners	
	Doctoral : Maroon with golden letters and golden corners	
Submission of <i>kaccha</i> bound thesis	It is mandatory to submit after completing thesis seminar before advisory committee members and complete all other requirements of PG Studies as per 45.1 and 45.2 (2019-20). Applicable from January 2020. Submit to the Dean of the respective college.	
No. of copies of <i>kaccha</i> bound thesis	For Master's : 1 For Doctoral : 2	
Separator between chapters	No separator throughout the thesis	
Page of Dedication	No Dedication page in the thesis	
Spine title (on <i>pakka</i> bound)	Student's Name Degree Discipline Year (All bold , CAPITAL and Font size 16)	
Decoration	No ornamentation or bordering of the pages	

Style of writing	Past tense, passive voice and in third person
Formula	Mathematical and chemical formulae should be carefully made out by computer (Insert - Equation) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Scientific name	In full at the first mention <i>e.g. Mangifera indica</i> L., thereafter abbreviate <i>e.g. M. indica</i>
Research paper from thesis	At least one paper/ manuscript should be published / accepted / submitted in reputed journal (for Ph. D.)
Points to ponder	Proper paragraph indentation (6 spaces) Try to avoid duplication of tables and graphs Better to start paragraph from the next page instead of keeping single line at the end of page

**EVALUATION OF GA₃ ON PERFORMANCE
OF COWPEA [*Vigna unguiculata* (L.) Walp.]**

BY
GOLAKIYA PRAYAGBHAI DINESHBHAI
B.Sc. (Hons.) Horticulture
REGISTRATION NO. 2020215021



DEPARTMENT OF VEGETABLE SCIENCE
ASPEE COLLEGE OF HORTICULTURE AND FORESTRY
NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI 396 450
GUJARAT STATE

NOVEMBER 2020

❖ A. Preliminary Pages ❖

1. Title page
2. Abstract
3. Certificate- I
4. Declaration
5. Acknowledgement
6. Contents
7. List of tables
8. List of figures
9. List of photographs
10. List of symbols and abbreviations
11. List of appendices

Scheme of Preliminary pages and Chapterization for MBA (ABM) Project Report

A. Preliminary Pages

1. Title Page
2. Executive Summary
3. Certificate - I
4. Declaration
5. Certificate of Project completion from Organization
6. Acknowledgement
7. Contents
8. List of tables
9. List of figures
10. List of photographs
11. List of symbols and abbreviations
12. List of appendices

B. Chapters

1. Industry Profile
2. Organization Profile
3. Introduction of the Project
4. Review of Literature
5. Research Methodology
6. Data Analysis and Interpretation
7. Findings ,Suggestions and Conclusion

C. End matter: References and Appendices

**EVALUATION OF GA₃ ON PERFORMANCE
OF COWPEA [*Vigna unguiculata* (L.) Walp.]**

**A THESIS SUBMITTED TO THE
NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI
IN PARTIAL FULFILMENT OF THE
REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF
MASTER OF SCIENCE
(HORTICULTURE)**

**IN
VEGETABLE SCIENCE**

**BY
GOLAKIYA PRAYAGBHAI DINESHBHAI**

**B.Sc. (Hons.) Horticulture
REGISTRATION NO. 2020215021**



**DEPARTMENT OF VEGETABLE SCIENCE
ASPEE COLLEGE OF HORTICULTURE AND FORESTRY
NAVSARI AGRICULTURAL UNIVERSITY**

**NAVSARI 396 450
GUJARAT STATE**

NOVEMBER 2020

Doctoral

**RESPONSE OF CLUSTER BEAN [*Cyamopsis*
tetragonoloba (L.) Taub.] TO FOLIAR
APPLICATION OF PGRS**

BY

PATEL HIMANI BIHARILAL

M. Sc. (Horticulture) Vegetable Science

Registration No. 1020215011



**DEPARTMENT OF VEGETABLE SCIENCE
ASPEE COLLEGE OF HORTICULTURE AND FORESTRY
NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI 396450
GUJARAT STATE**

NOVEMBER 2020

❖ A. Preliminary Pages ❖

1. Title Page
2. Abstract
3. Certificate - I
4. Declaration
5. Acknowledgement
6. Contents
7. List of tables
8. List of figures
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10. List of symbols and abbreviations
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**Scheme of Preliminary pages and Chapterization for MBA (ABM) Project
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B. Chapters

1. Industry Profile
2. Organization Profile
3. Introduction of the Project
4. Review of Literature
5. Research Methodology
6. Data Analysis and Interpretation
7. Findings ,Suggestions and Conclusion

C. End matter: References and Appendices

Title page
RESPONSE OF CLUSTER BEAN [*Cyamopsis*
***tetragonoloba* (L.) Taub.] TO FOLIAR**
APPLICATION OF PGRS
A THESIS SUBMITTED TO THE
NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF
DOCTOR OF PHILOSOPHY (HORTICULTURE)
IN
VEGETABLE SCIENCE
BY
PATEL HIMANI BIHARILAL
M. Sc. (Horticulture) Vegetable Science
REGISTRATION NO. 1020215011



DEPARTMENT OF VEGETABLE SCIENCE
ASPEE COLLEGE OF HORTICULTURE AND FORESTRY
NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI 396 450
GUJARAT STATE

NOVEMBER 2020

DEPARTMENT OF VEGETABLE SCIENCE
ASPEE COLLEGE OF HORTICULTURE AND FORESTRY
NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI - 396450
GUJARAT

Student	Major Guide
Patel Himani Biharilal	Dr. S. N. Saravaiya

RESPONSE OF CLUSTER BEAN [*Cyamopsis tetragonoloba* (L.) Taub.]
TO FOLIAR APPLICATION OF PGRS

(Font size 13 point, center & Bold)

ABSTRACT

A field experiment was carried out, with a view to study the “RESPONSE OF CLUSTER BEAN [*Cyamopsis tetragonoloba* (L.) Taub.] TO FOLIAR APPLICATION OF PGRS” at the Regional Horticultural Research Station of the Navsari Agricultural University, Navsari, Gujarat, India during Summer 2016 and 2017 on cv. Pusa Navbahar. The experiment was conducted in randomized block design (RBD) with three replications, which included 13 treatments namely, T₁ : NAA 20 mg l⁻¹, T₂ : NAA 40 mg l⁻¹, T₃ : NAA 60 mg l⁻¹, T₄ : GA₃ 20 mg l⁻¹, T₅ : GA₃ 40 mg l⁻¹, T₆ : GA₃ 60 mg l⁻¹, T₇ : Thiourea 250 mg l⁻¹, T₈ : Thiourea 500 mg l⁻¹, T₉ : Thiourea 750 mg l⁻¹, T₁₀ : NAA 20 mg l⁻¹ + GA₃ 20 mg l⁻¹, T₁₁ : NAA 20 mg l⁻¹ + Thiourea 250 mg l⁻¹, T₁₂ : GA₃ 20 mg l⁻¹ + Thiourea 250 mg l⁻¹ and T₁₃ : Control.

CERTIFICATE - I (Font size 16, CAPITAL & Bold)

This is to certify that the thesis entitled **RESPONSE OF CLUSTER BEAN [*Cyamopsis tetragonoloba* (L.) Taub.] TO FOLIAR APPLICATION OF PGRS** submitted by **PATEL HIMANI BIHARILAL** in partial fulfilment of the requirements for the award of the degree of **Doctor of Philosophy (Horticulture) in Vegetable Science** of the Navsari Agricultural University, Navsari is a record of bonafide research work carried out by her under my guidance and supervision and the thesis has not been previously formed the basis for the award of any degree, diploma or has been published for other similar title. All the assistance and help received during the course of investigation have been duly acknowledged.

Place: Navsari
Date: 02 November, 2020

Dr. S. N. Saravaiya
Major Guide & Professor
Department of Vegetable Science
ASPEE College of Horticulture and Forestry
NAU, Navsari

DECLARATION

This is to declare that the whole of the research work reported here in the thesis for the partial fulfilment of the requirements for the award of the degree of **Doctor of Philosophy (Horticulture)** in **Vegetable Science** by the undersigned is the result of investigation carried out by me under the direct guidance and supervision of **Dr. S. N. Saravaiya**, Professor, Department of Vegetable Science, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari - 396 450 and no part of the work has been submitted for any other degree so far.

Place: Navsari

Date: 02 November, 2020

(Patel Himani Biharilal)

Countersigned by

Dr. S. N. Saravaiya
Major Guide & Professor
Department of Vegetable Science
ASPEE College of Horticulture and Forestry
NAU, Navsari

ACKNOWLEDGEMENT

The success of this study is not only due to my efforts, rather a cumulative effect of proper guidance and encouragement of many others. So, I would like thanking them for their help for the successful completion of my Ph. D. study.

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LIST OF SYMBOLS AND ABBREVIATIONS

SYMBOLS		
	:	
	:	
	:	
	:	
	:	

ABBREVIATIONS		
	:	
	:	
	:	
	:	
	:	

Note:- No need to mention common symbols and abbreviations

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CHAPTER 1

INTRODUCTION

Technological breakthrough in Indian agriculture has brought about rapid increase in the productivity levels of crops. In agricultural scenario of different countries, vegetable farming is given precedence attention in view of the great importance of these crops due to a good source of income to the growers and forms a vital part of human diet in terms of nutrition such as leguminous vegetables which are the rich source of protein, fibres, mineral and vitamins.

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] belongs to family Fabaceae and popularly known as *guar*, is an important legume vegetable crop. It is an important cash crop in rainfed, especially in semi arid and arid regions of India. It is hardy as well as drought tolerant crop. Its deep penetrating root system enables the plant to utilize available moisture more efficiently and thus offers better scope for rainfed cropping. The crop survives best even at moderate salinity and alkalinity. Cluster bean is grown for its young tender green immature pods, which are used as a nutritive vegetable (Appendix-I). It can be grown on almost all types of soil. It can grow well in *Kharif* and summer seasons. Young pods are a source of delicious vegetable from late summer to the mid of rainy season (Kumar and Singh, 2002).

In spite of commercial importance of cluster bean crop in our daily diet and wide spread cultivation; availability of good quality cluster bean is not satisfactory (Patel *et al.*, 2015). In India, total vegetables are cultivated in an area of 10.10 million ha, with an annual production of 169.06 million MT (Anon., 2016a). Among these, Gujarat occupies an area of cluster bean of 0.04 million ha, with an annual production of 0.39 million MT (Anon., 2016b).

CHAPTER 2

REVIEW OF LITERATURE

Cluster bean is drought, hardy, deep rooted and summer annual legume (Sharma and Lashkari, 2009b). It is one of the most important leguminous crop of India as well as the world and extensively cultivated during *Kharif* and summer seasons which produces more vegetative growth than is needed for maximum pod production and yield especially when climatic conditions favour vegetative growth. It is one of the most important commercial legume crops grown all over India for its highly nutritive as well as medicinal value and remunerative price. The growth, yield and quality of cluster bean are largely dependent on number of interacting factors such as agro climatic conditions, seed material, sowing time, plant density, bio-inoculant and humic acid application, plant population and plant protection measures. However, very little systematic research work have been conducted on cluster bean in India and abroad for various aspects such as use of plant growth regulators like NAA, GA₃, Thiourea, *etc.* in respect to growth, yield and quality. Therefore, the research work done on other leguminous crops like cowpea, french bean, pea, faba bean, *etc.* has been also reviewed in this chapter and available references are included under the following sub heads:

2.1 ROLE OF PLANT GROWTH REGULATORS (Font size 12, Caps, 1.5 spacing)

Plant growth regulators (PGRs) are organic compounds, other than nutrients, that modify plant physiology. PGRs, called biostimulants or bioinhibitors, act inside plant cells to stimulate or inhibit specific enzymes or enzyme systems and help to regulate plant metabolism. They normally active at very low concentrations in plants.

The growth and development of plant is a complex process and is under the control of three main factors viz., genetics, environment and endogenous growth substances. The genetic factors determine the potentiality of a plant for growth and the fullest expression of this potential in turn is under the control of various environmental factors. The enhanced productivity of crop through physiological approaches is chiefly achieved by coordinating plant processes to synthesize maximum dry matter production and partitioning major quantum of this increased dry matter into effective yield contributing factors.

CHAPTER 3

MATERIALS AND METHODS

The present investigation entitled “RESPONSE OF CLUSTER BEAN [*Cyamopsis tetragonoloba* (L.) Taub.] TO FOLIAR APPLICATION OF PGRS” was carried out at Regional Horticultural Research Station (RHRS), Navsari Agricultural University, Navsari during Summer 2016 and 2017 on cv. Pusa Navbahar. The details of materials used, methods followed and the techniques adopted during the period of experiment have been described here under.

3.1 GENERAL (Font size 12, bold, Caps, 1.5 spacing)

3.1.1 Location (Font size 12, bold, Non caps, 1.5 spacing)

Navsari, where the present investigation was undertaken is geographically situated at coastal region of South Gujarat at 20° 37' N latitude and 72° 54' E longitude with an altitude of 11.98 meters above the mean sea level. The weather during the growing season was normal and favourable for crop growth.

3.1.2 Experimental Site (Font size 12, bold, First letter of each word Caps, 1.5 spacing)

The present investigation was carried out during Summer 2016 and 2017 at Regional Horticultural Research Station, Navsari Agricultural University, Navsari, in block ‘E’, plot No. 6 (Photo 1).



Photo 1: General view of experimental plot

3.1.3 Climate

According to agro-climatic conditions of Gujarat state, Navsari falls under ‘South Gujarat Heavy Rainfall Zone, AES-III’. The climate of this zone is typically tropical. The average rainfall of the tract is about 1500 millimetre (mm) and is normally received by June and ceases by September end.

3.1.4 Weather

The meteorological data on maximum and minimum temperatures, morning and afternoon relative humidity, wind velocity, sun shine, total rainfall, total rainy days and evaporation were recorded at the Agro-Meteorological Observatory of College Farm, N. M. College of Agriculture, N. A. U., Navsari for the period from March-2016 to May-2017. The data so collected are tabulated in Appendix II.

3.1.5 Soil Characteristics

The soil of South Gujarat is locally known as ‘black cotton soil’. As per the soil taxonomy, the experimental soil belongs to order Inceptisols, sub-order Ochrepts, great soil group vertic Ustochrepts under the soil series of Jalalpore (South Gujarat). The experimental soil was deep black, having well drainage as well as good water holding capacity and reasonably suitable for cluster bean growing. Cluster bean can grow on a wide range of different soil types. Preferably in fertile, medium-textured and sandy loam soils that are well-drained because water logging decreases plant performance. In respect of soil acidity, guar grows best in moderate alkaline conditions.

3.1.6 Selection of Variety

The present investigation was carried out on Pusa Navbahar variety. It was developed by crossing between Pusa Do-mausami and Pusa Sadabahar. It is high yielding, photo-insensitive and vegetable purpose variety. Generally, light green soft and very meaty with profuse bearing in branches. This variety has wide adaptability and can be grown throughout India. It is especially popular for longer and better quality pods. The plants are unbranched and produce cluster of pods at each node. Usually, mature seeds are whitish gray. The disadvantage of this variety is susceptible to bacterial leaf blight disease and lodging. The certified seed of this variety was procured from Main Vegetable Research Station, Anand Agricultural University, Anand.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter embodies the research results of the field investigation entitled "RESPONSE OF CLUSTER BEAN [*Cyamopsis tetragonoloba* (L.) Taub.] TO FOLIAR APPLICATION OF PGRS" carried out during summer seasons of 2016 and 2017 at the Regional Horticultural Research Station (RHRS) of the Navsari Agricultural University, Navsari, Gujarat, India. The experiment included 9 treatments in a randomized block design with 3 replications. The data recorded during both the years of study, on various aspects were tabulated and subjected to statistical analysis. The research results pertaining to each aspect have been presented and described along with statistical inferences under the following heads:

4.1 YIELD ATTRIBUTES

4.1.1 Pod Yield (kg ha⁻¹)

The pod yield (kg ha⁻¹) was calculated on the basis of pod yield net plot⁻¹. The mean data pertaining to yield on both the years as well as that of pooled as influenced by different treatments have been presented in Table 4.1 and graphically illustrated in Figure 4.1.

An appraisal of yield data indicated that the yield was significantly affected.

During 2016, the maximum pod yield (13989.20 kg ha⁻¹) was observed with the treatment T₄ receiving GA₃ 20 mg l⁻¹, which was remained at par with the treatment T₁ (12770.06 kg ha⁻¹). The treatment T₁₀ receiving NAA 20 mg l⁻¹ + GA₃ 20 mg l⁻¹ recorded the minimum yield of pod (7550.15 kg ha⁻¹), which was found to be statistically at par with treatment *viz.*, T₉.

The mean yield data for 2017, indicated the same trend of treatments like that of the preceding year *i. e.* 2016 with respect to the highest yield of cluster bean pod. But it was at par with T₁ and T₁₁. On the other hand, treatment T₁₀ receiving NAA 20 mg l⁻¹ + GA₃ 20 mg l⁻¹ recorded the minimum pod yield of 6766.20 kg ha⁻¹, which was at par with treatment T₉.

Looking at the pooled analysis results, the pod yield ranged from 7158.18 to 13309.80 kg ha⁻¹. The maximum pod yield (13309.80 kg ha⁻¹) was noticed under the treatment of T₄ receiving GA₃ 20 mg l⁻¹, which was found to be statistically at par with the treatment T₁ only. However, the treatment T₁₀ (NAA 20 mg l⁻¹ + GA₃ 20 mg l⁻¹) observed the minimum pod yield (7158.18 kg ha⁻¹), which was found to be at par with the T₉. The interaction of year x treatment was found non - significant.

Table 4.1: Effect of different treatments on pod yield (kg ha⁻¹) of cluster bean cv. Pusa Navbahar

Treatments	Pod yield (kg ha ⁻¹)		
	2016	2017	Pooled
T ₁ : NAA 20 mg l ⁻¹	12770.06	11654.32	12212.19
T ₂ : NAA 40 mg l ⁻¹	10235.34	9420.53	9827.93
T ₃ : NAA 60 mg l ⁻¹	9444.45	7750.00	8597.22
T ₄ : GA ₃ 20 mg l ⁻¹	13989.20	12630.40	13309.80
T ₅ : GA ₃ 40 mg l ⁻¹	9899.69	8980.71	9440.20
T ₆ : GA ₃ 60 mg l ⁻¹	9205.25	8552.47	8878.86
T ₇ : Thiourea 250 mg l ⁻¹	11307.87	10076.39	10692.13
T ₈ : Thiourea 500 mg l ⁻¹	9436.73	8251.54	8844.14
T ₉ : Thiourea 750 mg l ⁻¹	8381.17	6993.83	7687.50
T ₁₀ : NAA 20 mg l ⁻¹ + GA ₃ 20 mg l ⁻¹	7550.15	6766.20	7158.18
T ₁₁ : NAA 20 mg l ⁻¹ +Thiourea 250 mg l ⁻¹	11051.70	10550.93	10801.31
T ₁₂ : GA ₃ 20 mg l ⁻¹ + Thiourea 250 mg l ⁻¹	10252.32	9208.33	9730.32
T ₁₃ : Control	9587.19	8556.33	9071.76
Year Mean	10239.32	9184	9711.66
S.Em. ±	786.92	794.20	505.31
C.D. at 5 %	2296.96	2318.21	1429.24
C.V. %	13.31	14.98	14.10
YT : S.Em. ±			790.56
YT : C.D. at 5 %			NS

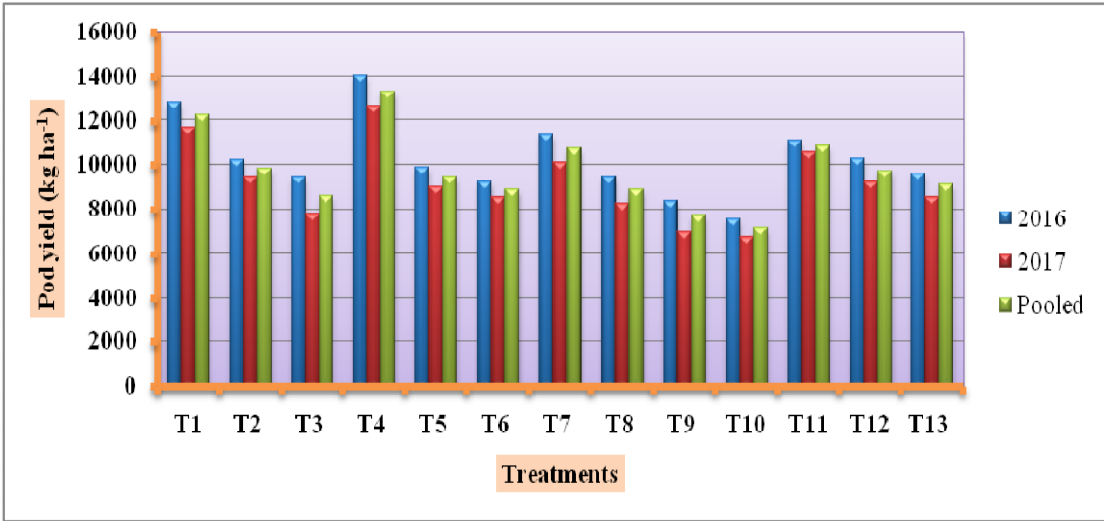


Fig. 4.1: Effect of different treatments on pod yield (kg ha⁻¹) of cluster bean cv. Pusa Navbahar

The pod yield (kg ha⁻¹) was significantly influenced by different foliar application treatments. The maximum pod yield was observed with GA₃ 20 mg l⁻¹. Since, pod yield is influenced by leaf area index, NAR and yield components and these all variables enhanced by exogenous plant growth regulators application. The pod yield in cluster bean depends on the accumulation of photo assimilates and redistribution of dry matter in plant, thereby bring about an improvement in yield potential. The present findings are in agreement with those reported by Poonia (2005), Yadav *et al.* (2006), Sharma and Lashkari (2009a), Sharma and Lashkari (2009b) and Patel *et al.* (2015) in cluster bean; Resmi and Gopalakrishnan (2004), Patel *et al.* (2011), Chatterjee and Choudhuri (2012), Golakiya *et al.* (2017a) and Golakiya *et al.* (2017b) in cowpea; Krishnan, Radha (2004), Rai *et al.* (2004), Ashwini (2005) and Rathod *et al.* (2015) in french bean; Mishriky *et al.* (1990), Pandey *et al.* (2004), Bora and Sarma (2006) and Thomson *et al.* (2015) in pea; Amin *et al.* (2014) in faba bean, and Maboko and Plooy (2015) in sweet pepper.

CHAPTER 5

SUMMARY AND CONCLUSIONS

The present study was carried out at the Regional Horticultural Research Station of the Navsari Agricultural University, Navsari, Gujarat, India during Summer 2016 and 2017 on cv. Pusa Navbahar to investigate the “RESPONSE OF CLUSTER BEAN [*Cyamopsis tetragonoloba* (L.) Taub.] TO FOLIAR APPLICATION OF PGRS”.

The experiment was conducted in randomized block design (RBD), which included 13 treatments namely, T₁ : NAA 20 mg l⁻¹, T₂ : NAA 40 mg l⁻¹, T₃ : NAA 60 mg l⁻¹, T₄ : GA₃ 20 mg l⁻¹, T₅ : GA₃ 40 mg l⁻¹, T₆ : GA₃ 60 mg l⁻¹, T₇ : Thiourea 250 mg l⁻¹, T₈ : Thiourea 500 mg l⁻¹, T₉ : Thiourea 750 mg l⁻¹, T₁₀ : NAA 20 mg l⁻¹ + GA₃ 20 mg l⁻¹, T₁₁ : NAA 20 mg l⁻¹ + Thiourea 250 mg l⁻¹, T₁₂ : GA₃ 20 mg l⁻¹ + Thiourea 250 mg l⁻¹ and T₁₃ : Control. The experiment included three replications.

The research results are summarized and the following are the salient findings of the present study:

5.1 SUMMARY

5.1.1 Influence of Time of Application

The effect of foliar application of NAA, GA₃ and Thiourea on growth characters namely, plant height at 60 DAS (95.10 cm) and at 90 DAS (142.83 cm); number of leaves plant⁻¹ at 60 DAS (18.50) and at 90 DAS (30.03); fresh weight of plant at 60 DAS (8.52 t ha⁻¹) and at 90 DAS (18.48 t ha⁻¹), dry matter content of plant at 60 DAS (1.58 t ha⁻¹) and at 90 DAS (2.90 t ha⁻¹) and stem diameter (1.79 cm) found significant on pooled analysis basis except days to 50 % flowering. Under all growth parameters, treatment T₄ (GA₃ 20 mg l⁻¹) found as a best treatment.

The different foliar application of PGR's significantly influenced on number of cluster plant⁻¹ (45.27), number of pods cluster⁻¹ (4.63), number of pods plant⁻¹ (197.57), pod length (10.91 cm), pod width (0.86 cm), pod weight (1.71 g) and number of seeds pod⁻¹ (8.50) on pooled analysis basis. Among 13 treatments, T₄ (GA₃ 20 mg l⁻¹) found best treatment.

From the economic point of view and based on green pod yield, for securing maximum return, foliar application of GA₃ 20 mg l⁻¹ was found superior with highest BCR value of 2.1 followed by T₁ (BCR value of 1.9). This treatment was found economical, profitable and proved highly remunerative for growth, yield and quality traits of cluster bean.

5.2 CONCLUSIONS

From the results of two years study, it was inferred that for securing maximum green pod yield with higher net profit of cluster bean cv. Pusa Navbahar, it is advisable to foliar spray of GA₃ 20 mg l⁻¹ at the time of 50 % flowering stage under south Gujarat Agro-climatic conditions.

These results however need to be further confirmed on multi-location large scale trials before passing as recommendations to the cluster bean growers of South Gujarat.

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Anonymous (2016b). Area Production. Director of Horticulture, Agriculture, Co-operation and Farmer Welfare Department, Government of Gujarat, p: 6.

Style of Reference

- References begins at a new page with the heading having Centre align, CAPS and bold – REFERENCES
- Line spacing 1.5
- References list entries should be indented half an inch or 12 mm (6 spaces) on the second and subsequent lines of the reference list for every entry.
- Arrange all references strictly in alphabetical order by the surname of the first author as the letters appear.
- Abbreviated names of the Journals may be used as per the standards.
- Visit www.apastyle.org for further details.
- Follow the style/ font (normal/ *italics*, initials of authors, punctuations etc.) as examples given in APPENDIX C.

APPENDIX-I

Nutritive value of vegetable cluster bean (100 g⁻¹ of edible portion)

Nutrients	Content
Moisture (g)	81.00
Protein (g)	3.20
Fat (g)	0.40
Carbohydrates (g)	10.80
Energy (kcal)	16.00
Vitamin A (IU)	316.00
Thiamine (mg)	0.09
Riboflavin (mg)	0.09
Niacin (mg)	0.60
Vitamin C (mg)	47.00

(Choudhary *et al.*, 2013)

CERTIFICATE - II

This is to certify that I have no objection for supplying to any scientist only one copy or any part of this thesis at a time through reprographic process, if necessary, for rendering reference services in a library or documentation centre.


Place: Navsari

Date: 02 November, 2020

(Patel Himani Biharilal)

SYNOPSIS FORMAT FOR PG RESEARCH NAU

-: APPENDIX B :-
-: GUIDELINES FOR SYNOPSIS FORMAT:-

University Emblem	Mandatory on Front Cover Page  Navsari Agricultural University 2.5 cm height × 5 cm width		
Title of synopsis	Concise (short) and precise (accurate)		
Paper	A4 Size white (8.27 inch × 11.69 inch or 21.0 cm x 29.7 cm)		
Page margin	Left: 1.5” (3.81 cm) Right: 1” (2.54 cm) Top:1” (2.54 cm) Bottom: 1” (2.54 cm)		
Line spacing	1.5		
Printing	On both sides of the sheet		
Font type & colour	Times New Roman , pure Black		
Font size	Topic heading – Left align		
	All CAPS	12 point	Bold
	Sub Topic heading – Left align		
	First letter of each word CAPITAL	12 point	Bold
	Sub Sub Topic heading – Left align		
	First letter of topic is CAPITAL	12 point	Bold
	Regular Text :Justify align		
		12 point	Normal
Page number	Beginning with the first page of the regular text, all pages should be continuously numbered	Centre align, Times New Roman, 12 Point, Bold , Continuous Arabic Number (1,2,3,4,..)	
Sequence	Proposal letter Annexure- I Front Cover Page Certificate- I Undertaking -1 Undertaking -2 Certificate – II Synopsis of PG research work Introduction Review of literature Technical programme of research work Methodology Observations to be recorded References		
No. of copies	05 hard copies and 01 soft copy to major guide		
Points to ponder	Tense: Future Proper paragraph Indentation (Before 6 pt and after 6 pt) Try to avoid duplication Sub heading indentation is up to four levels Approval of the Advisory Committee		

(For Masters’/ Doctoral)

Navsari Agricultural University
Faculty of Post Graduate Studies

ASPEE College of Horticulture and Forestry
Navsari Agricultural University, Navsari 396 450

PROPOSAL FOR APPROVAL OF SYNOPSIS

1.	Name of the Candidate (Full Name)	:	SARVAIYA JAYDIPBHAI PRABHUBHAI
2.	Degree for which registered	:	M.Sc. (Horticulture)
3.	Registration No.	:	2020219038
4.	Major Field of study	:	Vegetable Science
5.	Minor Field of study	:	Fruit Science
6.	Current semester	:	Second
7.	Title of Synopsis (In CAPITAL letters with double inverted comma). Botanical Name in small letters with <i>italics</i> . First alphabet of Generic name must be capital.)	:	“RESPONSE OF VEGETABLE COWPEA [<i>Vigna unguiculata</i> (L.) Walp.] TO FOLIAR APPLICATION OF PGRS”

Encl.: 1) Synopsis (Three copies)
2) Duly filled Annexure – I

Dr. S.N. Saravaiya
Major Guide & Professor
Department of Vegetable Science
ASPEE College of Horticulture and Forestry
Navsari Agricultural University
Navsari 396 450

Forwarded
No. NAU/ ACHF/ VEG/ PG/ SYN/ / /2020
Date: 14/ 11 /2020

Head of Department

Recommended
No. NAU/ ACHF/ PGT/ SYN/ / /2020
Date: / 11/2020

Principal/Dean

Copy FWCs to:
(1) The Dean, Post-Graduate Studies, Navsari Agricultural University, Navsari **for necessary approval**

Annexure -I

To,
Principal/ Dean
ASPEE College of Horticulture and Forestry
Navsari Agricultural University, Navsari

Subject: Approval of Synopsis of P. G. student

With reference to the above cited subject, please find approved synopsis of **Sarvaiya Jaydipbhai Prabhubhai**, Registration No. **2020219038**; a student of **M.Sc. (Horticulture)** in **Vegetable Science** subject for further necessary action.

Title of synopsis	“RESPONSE OF VEGETABLE COWPEA [<i>Vigna unguiculata</i> (L.) Walp.] TO FOLIAR APPLICATION OF PGRS”
-------------------	---

Encl.: As above
(Two copies)

DEAN P. G. STUDIES

Note: No change in the proposed thesis plan will be permitted without recommendation of advisory committee and final approval of Dean, PG studies.

Copy to:

1. The Registrar, Navsari Agricultural University, Navsari for information
2. Concern Major Guide: Dr.S. N. Saravaiya, Professor, Department of Vegetable Science, ASPEE College of Horticulture and Forestry,Navsari Agricultural University, Navsari - 396 450.

Synopsis of Post Graduate Research Work

**RESPONSE OF VEGETABLE COWPEA
[*Vigna unguiculata* (L.) Walp.] TO
FOLIAR APPLICATION OF PGRS**

Submitted to

Dean P.G. Studies

Navsari Agricultural University, Navsari

By

SARVAIYA JAYDIPBHAI PRABHUBHAI

M.Sc. (Horticulture) Vegetable Science

Registration No. 2020219038

DR. S. N. SARAVAIYA

Major Guide & Professor



Navsari Agricultural University

DEPARTMENT OF VEGETABLE SCIENCE

ASPEE COLLEGE OF HORTICULTURE AND FORESTRY

NAVSARI AGRICULTURAL UNIVERSITY

NAVSARI 396450

NOVEMBER 2020

CERTIFICATE - I

This is to certify that **SARVAIYA JAYDIPBHAI PRABHUBHAI**,
(Reg. No. 2020219038) has presented the synopsis of post graduate research work in
the 14th RAC Meeting of Vegetable Science (Part - II) held on **03/04/2020** at the
Conference Hall, ASPEE College of Horticulture and Forestry, N.A.U, Navsari. All
the comments and relevant suggestions made by the house have been incorporated.

Place: Navsari

Date: 03/11/2020

Dr. S. N. Saravaiya
Major Guide & Professor
Department of Vegetable Science
ASPEE College of Horticulture and Forestry
Navsari Agricultural University
Navsari- 396450

UNDERTAKING -1

This is to declare that I have no objection if data / observations / findings generated by me during PG research are utilized by Major Guide in future for preparing any project or making recommendation or nomination for award.

Place: Navsari

(Sarvaiya Jaydipbhai Prabhubhai)
Student

Date: 03 /11/2020

UNDERTAKING -2

It is mandatory for the Major Guide to fill either Part ‘A’ or ‘B’

Part ‘A’

All necessary resources for undertaking the proposed research entitled “RESPONSE OF VEGETABLE COWPEA [*Vigna unguiculata* (L.) Walp.] TO FOLIAR APPLICATION OF PGRS” by SARVAIYA JAYDIPBHAI PRABHUBHAI (Reg. No. 2020219038) are available in the Department of Vegetable Science or ASPEE College of Horticulture and Forestry and no additional land/funds are required to complete it.

Major Guide

Part ‘B’

The proposed research entitled “RESPONSE OF VEGETABLE COWPEA [*Vigna unguiculata* (L.) Walp.] TO FOLIAR APPLICATION OF PGRS” by SARVAIYA JAYDIPBHAI PRABHUBHAI (Reg. No. 2020219038) in the Department of Vegetable Science or ASPEE College of Horticulture and Forestry would require the below mentioned for successful completion of research.

- (i) 0.5 ha Additional land other than that available with the Department / College
- (ii) Spray Drier Equipment
- (iii) 1,00,000/- (₹.) Chemical
- (iv) Collaboration with DMAPR, Anand

Major Guide

CERTIFICATE - II

This is to certify that post graduate research work entitled “**RESPONSE OF VEGETABLE COWPEA [*Vigna unguiculata* (L.) Walp.] TO FOLIAR APPLICATION OF PGRS**” has been submitted by **SARVAIYA JAYDIPBHAI PRABHUBHAI (Reg. No. 2020219038)** for the award of M.Sc. (Horticulture) degree in the discipline of Vegetable Science is a proposed research work to be undertaken.

Sr. No.	Name and Designation	Advisory Committee	Signature
1	Dr. S. N. Saravaiya Professor Department of Vegetable Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari - 396 450 Mob. No. : 9998002658	Major Guide	
2	Dr. Y.N. Tandel Associate Professor Department of Fruit Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari - 396 450 Mob. No. :9601283385	Minor Guide	
3	Dr. Sanjeev Kumar Assistant Professor Department of Vegetable Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari - 396 450 Mob. No. : 9805056754	Member	
4	Prof. H. N. Chhatrola Assistant Professor Dept. of Statistics and Computer Centre ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari - 396 450 Mob. No. : 9825028755	Member	

Note:

- Members of the advisory committee must be as per Common Academic Regulations for the PG programme from 2019-20 of NAU, Rule No. 30.2 (page 15).
- For Masters’ Students**, the advisory committee shall comprise of a Major Guide, Minor Guide and two Members.
- For Ph. D Students**, the advisory committee shall comprise of a Major Guide, Minor Guide and three Members.

SYNOPSIS OF PG RESEARCH WORK FOR THE DEGREE M.Sc. (HORTICULTURE) VEGETABLE SCIENCE

1.	Name of PG student (In CAPITAL & As per Registration)	:	SARVAIYA JAYDIPBHAI PRABHUBHAI
2.	Semester	:	Second
3.	Degree	:	M.Sc. (Horticulture) Vegetable Science
4.	Date of Registration	:	21/04/2020
5.	Registration No.	:	2020219038
6.	Major subject	:	Vegetable Science
7.	Minor subject	:	Fruit Science
8.	Major Guide	:	Dr. S. N. Saravaiya Professor Department of Vegetable Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari 396 450
9.	Minor Guide	:	Dr. Y.N. Tandel Associate Professor Department of Fruit Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari 396 450
10.	Title of research work	:	“ RESPONSE OF VEGETABLE COWPEA [<i>Vigna unguiculata</i> (L.) Walp.] TO FOLIAR APPLICATION OF PGRS ”
11.	Objectives	:	1. To evaluate the effect of foliar application of PGRs viz; NAA, PCPA, 2,4-D and CCC on growth parameters of vegetable cowpea 2. To evaluate the effect of foliar application of PGRs viz; NAA, PCPA, 2,4-D and CCC on yield and quality parameters of vegetable cowpea

INTRODUCTION

The cowpea [*Vigna unguiculata* (L.) Walp.] is grown for immature pods and mature grains. The haulms are also fed to livestock. It is the most widely cultivated pulse crop of Kerala. Cowpea is known as drought hardy nature, its wide and droopy leaves keeps soils and soil moisture conserved due to shading effect. It is also known as black-eyed pea or southern pea, *etc.* and has multiple uses like food, feed, forage, fodder, green manuring and vegetable. Cowpea seed is a nutritious component in the human diet and cheap livestock feed as well. Both the green and dried seeds are suitable for canning and boiling as well (Saravaiya *et al.*, 2014).

REVIEW OF LITERATURE

Research work on foliar application of PGRs for cowpea crop is scanty. An attempt is therefore, made to present a brief summary of the work carried out by various scientist in India and abroad relating to the present investigation. The relevant and important published work available on other leguminosae family crop (black gram, chick pea, cluster bean, french bean, mung bean, pea, soyabean, Yard long bean) has been reviewed and presented here under.

Black gram (*Phaseolus mungo* Roxb.)

Mehrotra *et al.* (1968) at the Government Research Farm, Kanpur studied the effects of hormone sprays on pod setting, pod filling and grain yield of black gram with the different treartments....

Chickpea (*Cicer arietinum* L.)

Upadhyay (2002) conducted a field experiment at Berthin, Himachal Pradesh, India to study the effect of NAA, GA₃ and Kinetin (10, 20, and 30 ppm) on chickpea physiology and yield parameters.

Cluster bean (*Cyamopsis tetragonoloba* L.)

Sharma and Lashkari (2009) at JAU, Junagadh studied the response of Gibberellic acid, NAA and Cycocel on growth and yield of cluster bean cv. ‘Pusa Navbahar’.

Satodiya and Chauhan (2012) at Anand Agricultural University, Anand studied the response of growth and its quality in cluster bean to source manipulation and plant growth regulators.

Cowpea [*Vigna unguiculata* (L.) Walp.]

Desai and Deore (1985) studied the influence of growth regulators on the production of cowpea at MPKV, Rahuri. ...

Shinde and Jadhav (1995) studied the influence of foliar application of NAA, ethrel and KNO₃ on leaf physiology and yield of cowpea cv. VCM-8 at KKV, Dapoli....

Ganiger *et al.* (2003) at University of Agricultural Sciences, Dharwad studied the yield and chlorophyll content in cowpea as influenced by different growth regulators with the different treatments

Mohandoss and Rajesh (2003) studied the effect of GA₃ and 2, 4-D on growth and yield of cowpea at Annamalai. ...

French bean (*Phaseolus vulgaris* L.)

Rathod *et al.* (2015) at College of Agriculture, Latur studied the growth and yield parameters like height of plant, plant spread, number of leaves, number of branches, number of green pods, yield per plant on the French bean cv. Arka Komal with nine treatments

Rai *et al.* (2004) reported that GA₃ (100 and 200 mg l⁻¹) and NAA (50 mg l⁻¹) caused excessive vegetative growth resulting in maximum plant height and inter node length due to stimulation of faster cell division and cell enlargement. ...

Mungbean (*Vigna radiata* (L.) Wilczek.).

Kalita (1989) observed the effect of phosphate and growth regulators on green gram when sprayed with different concentrations of phosphorus alone or in combination with 50 or 100 ppm of NAA improved yield and yield components.

Pea (*Pisum sativum* L.)

Mishriky *et al.* (1990) studied the effects of GA₃ as a growth promoter and CCC as a growth retardant at the Experimental Station of Cairo University in the winter seasons of 1986-87 and 1987-88, using pea cv. Little Marvel.

Singh *et al.* (2015) studied the effect of GA₃ and NAA on growth and quality of garden pea (*Pisum sativum* L.) cv. Arkel at SHIATS, Allahabad with different treatments of GA₃(50, 100, 150, 200 ppm)) and NAA (15, 25, 35, 45 ppm) along with control.

Thomson *et al.* (2015) at CP College of Agriculture, SD Agricultural University, Sardarkrushinagar conducted an experiment on garden pea (*Pisum sativum* L.) cv. Bonneville to study the effect of plant growth substances and antioxidants on yield as well as quality attributes with eleven treatments

Soyabean (*Glycine max* L.)

Govindan *et al.* (2000) in Tamil Nadu studied the effect of foliar application of growth regulators ...

Upadhyay and Ranjan (2015) at Uttarakhand University of Horticulture and Forestry, Ranichauri campus, Tehri Garhwal (Uttarakhand) studied the effect of foliar application of growth hormones (NAA, GA₃ and Kinetin) on morphological parameters, yield and quality of soybean in completely randomized block design (CRBD) with three replications and ten treatments comprised of three concentrations (10, 20 and 30 ppm) of NAA, GA₃, Kinetin and control. ...

Yard long bean (*Vigna unguiculata* var. *sesquipedalis* (L.) Verdcourt)

Resmi and Gopalakrishnan (2004) at Vellanikkara, Thrissur studied the effects of plant growth regulators on the performance of yard long bean (*Vigna unguiculata* var. *sesquipedalis* (L.) Verdcourt) with the treatments included four synthetic growth regulators

TECHNICAL PROGRAMME OF RESEARCH WORK

Location	RHRS, Vegetable Research Farm ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari 396 450
Year & Season	2020 & Summer
Crop & Variety	Cowpea & cv. AVCP 1
Statistical Design	Randomized Block Design (RBD)
Number of treatments	13
Replications	3
Plot Size	Gross : 3.6 m x 3.0 m Net : 2.7 m x 1.8 m
Spacing	45 cm x 30 cm
Seed rate	25 kg ha ⁻¹
No. of row plot ⁻¹	8
No. of plants row ⁻¹	10
No. of plants plot ⁻¹	Gross: 8 x 10 = 80 Net : 6 x 6 = 36
No. of Experimental plot	39

Treatments

- T₁ : Control (No spray)
T₂ : NAA 10 mg l⁻¹
T₃ : NAA 15 mg l⁻¹
T₄ : NAA 20 mg l⁻¹
T₅ : PCPA 10 mg l⁻¹
T₆ : PCPA 15 mg l⁻¹
T₇ : PCPA 20 mg l⁻¹
T₈ : 2,4-D 0.5 mg l⁻¹
T₉ : 2,4-D 1.0 mg l⁻¹
T₁₀ : 2,4-D 1.5 mg l⁻¹
T₁₁ : CCC 200 µl l⁻¹
T₁₂ : CCC 300 µl l⁻¹
T₁₃ : CCC 400 µl l⁻¹

Time of foliar application of PGRs

1. NAA, PCPA and 2,4-D will be applied as foliar sprays at 20,30 and 40 days after sowing (DAS).
2. CCC a growth retardant will be sprayed at 20 days after sowing (DAS) only.

OBSERVATIONS TO BE RECORDED

A. GROWTH PARAMETERS

1. Days to 50% flowering
2. Number of leaves plant⁻¹ at final picking
3. Leaf area at final picking(cm²)
4. Leaf area index at final picking
5. Plant height at final picking (cm)
6. Days to first picking
7. Days to last picking
8. Primary branches plant⁻¹ at final picking
9. Fresh weight of plant at final picking (kg)

B. POD CHARACTERS

1. Pod length (cm)
2. Marketable pods plant⁻¹

C. YIELD PARAMETERS

1. Marketable pod yield plant⁻¹ (kg)
2. Marketable pod yield plot⁻¹ (kg)
3. Marketable pod yield (t ha⁻¹)
4. Harvest Index (%)
5. No. of pickings

D. QUALITY CHARACTERS

1. Protein content of immature seed (%)
2. Moisture content of pod (%)
3. Crude fibre (%)
4. TSS (⁰B)
5. Chlorophyll content of leaf and pod (mg 100 g⁻¹)

E. PEST AND DISEASE INCIDENCES (if any)

F. ECONOMICS

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Style of Reference

- References begins at a new page with the heading having Centre align, CAPS and bold – **REFERENCES**
- Line spacing 1.5
- References list entries should be indented half an inch or 12 mm (6 spaces) on the second and subsequent lines of the reference list for every entry.
- Arrange all references strictly in alphabetical order by the surname of the first author as the letters appear.
- Abbreviated names of the Journals may be used as per the standards.
- Visit www.apastyle.org for further details.
- Follow the style/ font (normal/ *italics*, initials of authors, punctuations etc.) as examples given in **APPENDIX C**.

Sarvaiya Jaydipbhai Prabhubhai
Student

Dr. S. N. Saravaiya
Major Guide & Professor

Place: Navsari

Date: 03/11/2020

RESEARCH ADVISORY COMMITTEE

Sr. No.	Name and Designation	Advisory Committee	Signature
1	Dr. S. N. Saravaiya Professor Department of Vegetable Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari-396450 Mob. No. 9998002658	Major Guide	
2	Dr. Y.N. Tandel Associate Professor Department of Fruit Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari-396450 Mob. No. 9601283385	Minor Guide	
3	Dr. Sanjeev Kumar Assistant Professor (Vegetable Science) Department of Vegetable Science ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari-396450 Mob. No. 9805056754	Member	
4	Prof. H. N. Chhatrola Assistant Professor Dept. of Statistics and Computer Centre ASPEE College of Horticulture and Forestry Navsari Agricultural University, Navsari-396450 Mob. No. 9825028755	Member	

APPENDIX - C

References

Points to ponder

- Many readers will look at the references to see whether you have cited their papers or not.
- Use more readily available research papers
- All should be cited in the text.
- The caption ‘Bibliography’ (History of books, List of books) may be avoided.
- Arrange alphabetically in the **References**, but Chronologically in the text, if possible.
- Should be unnumbered
- In the text only surname of author is accompanied by the (YoP) in the bracket (Surname & year systems; Harvard system)

Saravaiya (1985). For one author

Saravaiya and Patel (1986). For two authors

Saravaiya *et al.* (1987) For more than two authors

Tandel (1986a), Tandel (1986b), if the author is same and (YoP) is also same.

Anonymous (1989), if author is not specific.

- All the references cited in the text (5 **CHAPTERS**) should be arranged in an alphabetical order of the surname of author in **References**.
- Works by the same author should be listed in the order of YoP. *e.g.*
Gunaga, R. P. (1989).
Gunaga, R. P. (1990).
Gunaga, R. P. (2002).

- Research work by the same author along with other, if any will then follow in the alphabetical order.
Shukla, S.P. and Senapati, A.K. (2005).
Shukla, S.P. and Tiwari, N.K. (2009).

- Each reference should give the surname of author, (YoP), title of research paper, Abbreviated name of journal (*Italics*), the volume number (**boldface**), issue number and pages as per following examples.

The reference must include

- Name (s) of the author (s) (use comma) and full stop at the end (,).
- Surname (Full) and First letter of First and Middle name
- Leave half inch space for next lines.
- Year of publication (in parenthesis) followed by full stop at the end (**1989**).
- Title of the paper/article and full stop (,).
- Name of periodical (*Italics*) followed by comma (,).
- Volume No. (**Bold face**)

- Number of issue (in parenthesis) followed by colon mark (:) and
- Page numbers.
- “Of” , “The” & “In” should be removed but not “and” from the title of journal.

Citation from Journal

- Badole, S.B. and More, S.D. (2000). Soil organic carbon status as influenced by organic and inorganic nutrient sources in vertisol. *J. Maharashtra Agric.Univ.*, **25** (2) : 220-222.
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Citation from Chapter in Book

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- **Note:** pp. 132-140 & 309-312 means that the Author chapter is within these pages in that book.
 - **Citation from Conference / Seminar / Symposium /Workshop / Proceedings:**
- Muthuvel, P. P.; Purushothaman, K. and Kothandaraman, S. (1982). Efficient recycling of farm and industrial waste. In: *Proc. summer institute of fertilizer use efficiency in crop production*, Tamil Nadu Agricultural University, Coimbatore, India, **140 p.**

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- **140 p.** means total pages of the proceedings have been referred
- **p.140** means 140th page of the souvenir has been referred
- **Citation from Institution /Society Publications**

Deshmukh, P.H.; Magar, S.S. and Kadam, J. R. (1996). *Highlights of research on crops and varieties for salt affected soils of Karnal*, Central Soil Salinity Research Institute, Karnal, 28 p.

Chakraborty, D.P.; Ghosh, G.C. and Dhua, S.P. (1989). *Research highlights: 1986-89*. G. B. Pant University of Agriculture and Technology, Pantnagar, 113 p.

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Vasavada, J. (2020). Controversial Russian corona virus vaccine shows immune response; no major side-effects reported, shares Lancet study. *The Times of India*, August 5, p. 10.

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Original not seen*

-: APPENDICES :-

- Usually numbered with Roman Numerals (i, ii, iii...) (**APPENDIX I**), which includes:
- Large tables of original data ,Weather data, ANOVA , Cost of cultivation, List of inputs, Supplementary information, survey questionnaire format, other relevant information

Numerical Expressions: Roman: Arabic Numerals

I	i	1	XI	xi	11	XXX	xxx	30
II	ii	2	XII	xii	12	XL	xl	40
III	iii	3	XIII	xiii	13	L	l	50
IV	iv	4	XIV	xiv	14	LX	lx	60
V	v	5	XV	xv	15	LXX	lxx	70
VI	vi	6	XVI	xvi	16	LXXX	lxxx	80
VII	vii	7	XVII	xvii	17	XC	xc	90
VIII	viii	8	XVIII	xviii	18	C	c	100
IX	ix	9	XIX	xix	19	D	d	500
X	x	10	XX	xx	20	M	m	100

Abbreviations of some important journals

Indian Journals

<i>Curr. Sci.</i>
<i>Fertil. News</i>
<i>Indian J. Agron.</i>
<i>Indian J. Agril. Sci.</i>
<i>J. Indian Soc. Soil Sci.</i>
<i>Sci. and Cult.</i>

Foreign Journals

<i>Agron. J.</i>	
<i>Australian J. Agric. Res.</i>	
<i>Australian J. Expl. Agric. and Anim. Husb.</i>	
<i>Canadian. J. Soil Sci.</i>	
<i>Canadian. J. Pl. Sci.</i>	
<i>Expl. Agric.</i>	
<i>Cambridge. J. Agric. Sci.</i>	
<i>Emp. J. Expl. Agric.</i>	
<i>J. Soil. Sci.</i>	

<i>Acta Horticulturae</i>	<i>Bioscience</i>
<i>Plant Archives</i>	<i>Nature</i>
<i>Agric. Today</i>	<i>Phytopathology</i>
<i>J. Maharashtra Agric. Univ.</i>	<i>Phytoparasitica</i>
<i>J. Indian Soc. Soil Sci.</i>	<i>Ann. Agri. Bio. Res.</i>
<i>Proc. Third Int. Sympo. Trop. Sub-trop. Hort.,</i>	<i>Phytochemistry</i>
<i>Chronica Botanica</i>	<i>Phytosynthetica</i>
<i>Technology</i>	<i>PANS</i>
<i>Pestology</i>	<i>Pesticide</i>
<i>Science</i>	<i>Biometrics</i>
<i>Fertl. Tech.</i>	<i>Mycologia</i>
<i>Agric. Res. J. Kerala</i>	<i>Weather</i>
<i>Thesis M.Sc. (Agri.)</i>	<i>Euphytica</i>
<i>Thesis Ph.D.</i>	<i>Heredity</i>
<i>Madras Agric. J.</i>	<i>Rehabitatio</i>
<i>South Indian Hort.</i>	<i>J. Soils and Crops</i>
<i>Proc. Amer. Soc. Hort.Sci. Veg. Sci.</i>	<i>Annals Agric. Res.</i>
<i>Nematologia</i>	<i>Indian J. Agron.</i>
<i>Ann. Rev. Entomol.</i>	<i>J. Ornamental Hort.</i>
<i>J. Indian Soc. Soil Sci.</i>	<i>Proc. American. Soc. Soil Sci.</i>
<i>J. Sci. Technol.</i>	<i>Int. Chickpea News Letter</i>
<i>Indian J. Agric. Sci.</i>	<i>J. Agric. Univ.</i>
<i>Arid Soil Res.</i>	<i>Soil Microbiology and Biochem.</i>

<i>Soils and Fertil.</i>	<i>J. Spices and Aromatic Crops.</i>
<i>Karnataka J. Agric. Sci.</i>	<i>Bull. Kanagawa Hort. Exp. Sta.</i>
<i>Hort. J.</i>	<i>J. Maharashtra Agric. Univ.</i>
<i>J. Indian Soc. Soil Sci.</i>	<i>Planta</i>
<i>Ogrodnictwo</i>	<i>Punjab Hort. J.</i>
<i>Advan. Agric. Res.</i>	<i>Allahabad Fmr.</i>
<i>Microbiologia</i>	<i>Ann. Agric. Res</i>

One word journal names like Science, Bioscience, Nature, phytopathology etc. are never abbreviated.

Proof readers‘ marks:

Turn out/delete	⋈	Single quote;	‘ ’
Insert	^	apostrophe	’
Let it stand	~ ~ ~	comma	,
More space	#	Full stop	⊙
Less space	∪	Hyphen	- /
Close up	⌋ ⌌	Wrong font	w.g.
Raise	⌈ ⌉	Set in italic	<i>ital</i>
Lower	⌋ ⌌	Use small caps	SC
Move left	[Use Capitals	ALL CAPS
Move right]	Use lower case	l = lc
Push down	↓	Use Roman Type	rom
Bad letter	x	Transpose	tr
Paragraph	¶	Inferior figure	sub
No paragraph	no ¶	Bold face	bf
Straighten line	—	Spelling	spell
Braces	9	‘Run in’ copy	“ ” Z.....
Quote marks	“ ”		

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS
0+1

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc.
To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing –
Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; NAU synopsis and Thesis Format, Editing and proof-reading; Writing of a review article.

Communication Skills –

Transformation of sentences, the voice, articles, Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Phonetic symbols and transcription; Accentual pattern: Participation in group discussion: Facing an interview; presentation of scientific papers.

[illegible][illegible]

:Note:

[illegible]