

CONTRIBUTIONS TO PARTIALLY BALANCED INCOMPLETE BLOCK
DESIGNS AND THEIR APPLICATIONS

by

BISHAN SINGH

MICROFILMED

ROLL No.

72

72

DISSERTATION

SUBMITTED TO THE PUNJAB AGRICULTURAL UNIVERSITY
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

IN

STATISTICS

Department of Mathematics and Statistics
College of Basic Sciences and Humanities
Punjab Agricultural University
Ludhiana

1981

ACKNOWLEDGEMENTS

I express my deep sense of gratitude and indebtedness to my Major Advisor, Dr. Khen Raj Aggarwal, Associate Professor of Statistics, Department of Mathematics and Statistics, Punjab Agricultural University, Ludhiana for his able guidance, sustained encouragement, constructive criticism and valuable suggestions throughout the course of this investigation. This piece of work would not have been completed without his taking pains in checking and verification of the results.

I am also grateful to the other members of my Advisory Committee, Dr. P.A. Ramasubban, Ex-Professor-cum-Head, Department of Mathematics and Statistics; Dr. Dalbir Singh Dev, Professor of Animal Science (Extn.); Dr. Rajinder Singh Nawa, Reader, Punjab School of Economics, Guru Nanak Dev University, Amritsar; Dr. Ravindra Singh, Associate Professor of Statistics; Dr. Tejwant Singh, Assistant Professor of Mathematics and Dr. J.S. Dhillon, Associate Professor Dairy Cattle Breeding for their valuable suggestions and keen interest during the course of investigation.

I am highly grateful to Dr. G.S. Bhullar, Wheat Breeder, Punjab Agricultural University, Ludhiana and Dr. Manjit Singh Virk C.P.R.I. Simla for the constant help and encouragement received from them.

I am thankful to Mr. Surender Singh Yadava, Mr. Sham Lal Aggarwal, Mr. Kuljit Singh Bhatia, Mr. S.S. Mir, and Mr. K.G. Mehta for their everwilling help.

Financial assistance received from the Punjab
Agricultural University in the form of inservice candidature
is gratefully acknowledged.

I shall be failing in my duties if I do not record
my sincere thanks for the co-operation extended by my wife,
Mrs. Rajinder Kaur and children who spared full time for my
studies by sacrificing their needs and comforts.

Bishan Singh
(Bishan Singh)

CERTIFICATE I

This is to certify that this dissertation entitled, 'Contributions to Partially Balanced Incomplete Block Designs and their Applications', submitted for the degree of Ph.D., in the subject of Statistics of the Punjab Agricultural University, is a bonafide research work carried out by Bishan Singh under my supervision and that no part of this dissertation has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

K. R. Aggarwal
(Khem Raj Aggarwal)
Major Advisor

CERTIFICATE II

This is to certify that this dissertation entitled, 'Contributions to Partially Balanced Incomplete Block Designs and their Applications' submitted by Bishan Singh to the Punjab Agricultural University in partial fulfilment of the requirements for the degree of Ph.D., in the subject of Statistics has been approved by the Student's Advisory Committee after an oral examination on the same, in collaboration with an External Examiner.

K. R. Aggarwal
(Khem Raj Aggarwal) 15/7/1981
Major Advisor

H. K. Verma
(H. K. Verma)
Head of the Department

A. S. Atwal
13.8.87
(A. S. Atwal)
Dean of Post-Graduate Studies

C. R. Nair
External Examiner
(C. R. Nair)
Reader in Statistics
Punjab University
Patiala

C O N T E N T S

<u>Chapter</u>		<u>Pages</u>
1	INTRODUCTION	1-4
2	REVIEW OF LITERATURE	5-39
	2.1 Introduction	5
	2.2 Relations between the parameters of a PBIB design	7
	2.3 Eigen values of C-Matrix of a PBIB design	7
	2.4 Multiplicities of NN'	9
	2.5 Analysis of PBIB designs	11
	2.6 Triangular designs	15
	2.7 Double triangular and modified double triangular designs.	25
3	CONFOUNDED TRIALLEL EXPERIMENTS	40-52
	3.1 Introduction	40
	3.2 Extended triangular designs	40
	3.3 Application of $ET(p)$ design as confounded triallel experiments	46
4	SOME RESULTS ON EXTENDED TRIANGULAR DESIGNS	53-77
	4.1 Introduction	53
	4.2 Family-1 of $ET(p)$ designs	55
	4.3 Family-2 of $ET(p)$ designs	66
	4.4 Family-3 of $ET(p)$ designs	70
	4.5 Triangular designs	75
5	TRIAALLEL EXPERIMENTS WITH RECIPROCAL EFFECTS	78-91
	5.1 Introduction	78
	5.2 Confounded triallel experiments	78
	5.3 Series of modified extended triangular designs and relative loss of information	90
	LITERATURE CITED	92-94