

Department of Mathematics & Statistics



Dr. S.C.Gupta , Professor (Statistics)

Official Address: Department of Mathematics and Statistics,
CCS Haryana Agricultural University,
Hisar.

Home Address: 603 ,Sector 15 A Hisar, Haryana

Phone/Mobile: 01662-289201(O) 01662 -243703(R)
9355543703 (M)

E-mail: guptasc@hau.ernet.in

Academic Qualifications: Ph.D. (Statistics)

Professional Experience: 32 years Research/Teaching Experience

Academic Interests:

- Developing stochastic models using the concept of branching process.
- Population growth models with harvesting.
- Statistical methodology for AICRP (ICAR) on Cropping Systems
- Statistical consultation.

Research Highlights:

In genetic improvement programs, the most inferior genotype is being culled (removed) in different generations through artificial selection and mating is allowed among the remaining members of the population and thus the frequency of superior genotype is increased. In these programs, the breeder requires to answer the questions such as:

1. How many generations are needed to have the population with superior or healthy genotype?
2. What will be the size of the population with superior genotype?
3. What will be the size of discarded population in different generations?

The answer to these questions depends upon the type of mating system and method of selection used. Keeping these objectives in view, I have worked on 'Stochastic models using the

concept of branching process'. These models lead to the population structure at any time and hence the ultimate structure may be obtained.

An important aspect of a population is that it admits immigration and emigration where some members may leave the system, while some may enter the system at any time. Keeping this in view, the models of branching process with immigration and emigration are proposed.

For a population which identifies two types of individuals (e.g. male and female), two-dimensional models are proposed. The expressions for PGF of the population vector and expected population vector have been obtained.

The scope of application of these models has been identified. The model involving emigration has been applied to a genetic improvement program using artificial selection. The expected size with desirable genotype and the expected number of removals (discarded individuals) have been obtained. It has been studied under

- i. Phenotypic assortative mating system
- ii. Genotypic assortative mating system
- iii. Random mating system
- iv. Mixed mating system.

The assortative mating has a special merit over random mating as it increases the genotypic variance in the population hence more selection response and thus selection becomes more effective. The model with emigration has been modified for situations to study the effect of mutants on the genetic structure of the population (the mutants have been considered as immigrants).

The use of assortative in the long run is likely to have inbreeding in the population leading to an inbreeding depression. On the other hand, the use of random mating after selection, does not restore the genetic variance and hence there is less response to selection. Thus to make the genetic improvement program more vibrant and successful, it becomes more advantageous to use the mixed mating system and go on removing inferior genotype in different generations. For this situation, a model of branching process in varying environments is proposed which uses mix mating system i.e. assortative and random mating in alternate generations. The genetic structure of the population has been studied under (i) mix mating with complete selection against recessives, (ii) mix mating with complete selection against recessives and half selection against heterozygote.

Two-sex population models have been proposed using the concept of (i) female dominance, (ii) intermediate dominance. Female dominance means birth of any sex depends only on the number of females present in the population. Intermediate dominance means that the

birth of any sex depends upon the geometric average of the number of males and females. The effect of harvesting has also been superimposed in the model. The population structure has been studied with varying harvest rates. The model has been applied to study the growth of a cattle population.

The main work done under AICRP on Cropping Systems includes the application of statistical methodology such as field layout, scrutiny, statistical analysis and interpretation of research data and preparation of annual reports.

National/International Exposure:

Visited various Universities and Institutes in India in connection with conferences, workshops, symposia, viva-voce and examinations etc.

Awards & Honours:

ICAR Senior Research Fellowship during Ph.D. programme.

Awarded certificate of merit for scoring highest OGPA in Ph.D. for the academic year 1987.

Professional Affiliations:

Life member of Indian Society of Agricultural Statistics, New Delhi.

Life member of Society of Statistics, computer and Application, New Delhi.

Member of Society of Applied Statistics and computer Science, CCS HAU, Hisar.

Life member of Indian Statistical Association, Pune.

Manuals/Bulletins

Agricultural- Bio-resource characterization of zones in Haryana (2003)

Front Line Demonstrations on Pearl millet -Mustard cropping system in Haryana (2003)

Manual on Business Statistics(2008)

Manual on Non-parametric Tests(2009)

Important Publications:

A uniformity trial in pearlmillet. **Intern. J. Trop. Agri.** 1:41-49

A continuous-time branching process with migration. **Statistica** 49(4): 547-552 (1989)

A two-dimensional branching process with migration. **Commun Statist. Theory Meth.** 20(8): 2727-36 (1991).

A study of shape and size of experimental plots with groundnut. **Indian J.Agric. Res.**25(3) : 161-66 (1991)

Branching process with emigration- A genetic model. **Math. Biosci.** **111(1)** : 159-168 (1992)

A branching process with immigration and emigration. **Statistica** **52(4)**: 521-528 (1992)

Two-sex culling model. An application to cattle growth. **Indian J. Animal Sci.** **65(4)**: 430-434 (1995).

Branching process with emigration in varying environment. In Recent Advances on Information Theory, Statistics and Computer Applications (Eds. D.S.Hooda and R.C.Hasija), Deptt. of Mathematics & Statistics, CCSHAU, Hisar, 252-256 (1997).

Generation-dependent branching process: genetic model. In Proc. Annual Conf. Soc. Statist. Computer Applications (Eds.L.S.Kaushik, M.N.Das and V.K.Gupta), 58-64 (1998).

Some modified methods of selection in dairy cattle. In Proc. Annual Conf. Soc. Statist. Computer Applications (Eds.L.S.Kaushik, M.N.Das and V.K.Gupta), 123-30 (1998).

Parity dependent population growth model. **Statistica** **60(1)** : 45-57 (2000).

A branching process in varying environment-A mixed mating model. **J. Indian Soc. Agril. Statistics**, **59(3)**, :233-236 (2005).

A population growth model with varying growth rates. **J. Society of Statistics, Computer and Applications**, **4(2)**: 13-26 (2006).

A two-dimensional branching process-A dispersal model. Proceedings of workshop on remote sensing and GIS for rural development with special reference to Haryana.:163-169 (2006).

An application of branching kprocess to a genetic improvement program. Proceedings of workshop on remote sensing and GIS for rural development with special reference to Haryana.156-161 (2006).

Relative efficiency of incomplete block design in sesame (Sesamum Indicum). **Haryana agric. Univ. J. Res.****36**: 81-93 (2006).

Uniformity trial on Sesame (Sesamum indicum) **Environment and Ecology**.**255(2)**:295-298 (2007)

A harvest strategy for stable population structure. Haryana agri Univ. J.Res. (accepted). (2008)

A population growth model with varying growth rates. Haryana agri univ. J.Res. (accepted). (2008)

An age-dependent population growth model with culling. Conference on Emerging Trends in Statistics Methods and Optimization Techniques, Deptt. of Statistics, University of Jammu, Feb.22-23, 2008, p:64