AGRON-: GENETICS AND PLANT BREEDING

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Course Objectives
This course is an advancement of principles, various plant breeding methodologies and procedures in the development of a complex population; MAS for selection of qualitative and quantitative traits, Gene pyramiding, marker-based utilization of exotic Germplasm and introgression libraries.

UNITS	CONTENTS	CONTACT HRS.
I	Plant Breeding methodologies: Classic versus modern; Over view of Pre and Post Mendelian breeding methods in self and cross pollinated crops; Molecular and transgenic breeding approaches; doubled haploid breeding, shuttle breeding, forward and reverse breeding, speed breeding, participatory plant breeding, breeding for organic situations.	10
II	Genetic engineering technologies to create male sterility, prospects and problems , use of self- incompatibility and sterility in plant breeding – case studies; Fertility restoration in male sterile lines and restorer diversification programs; Conversion of agronomically idealgenotypes into male sterile: Concepts and breeding strategies; Case studies - Generating new cyto-nuclear interaction system for diversification of male sterile; Stability of male sterile lines – Environmental influence on sterility, Environmentally Induced Genic Male Sterility (EGMS) – Types of EGMS; Influence on their expression, genetic studies; Photoand thermo sensitive genetic male sterility and its use in heterosis breeding; Temperature sensitive genetic male sterility and its use heterosis breeding ; Apomixis and its use in heterosis breeding ; Incongruity : Factors influencing incongruity Methods to overcome incongruity mechanisms.	10
III	Genome sequencing: Principles and techniques of conventional approaches and next generation sequencing including sequencing-by-synthesis/ligation and single molecule real time (SMRT) technologies; Applications of sequence information: structural, functional andcomparative genomics;Plant genome projects: Strategies for genome sequencing including shot gun and clone-by-clone method.	10
IV	Population: Properties of population, Mendelian population; Genetic constitution of a population through time, space, age structure etc.; Frequencies of genes and genotypes; Causes of change: population size, differences in fertility and viability, migration and mutation.	15
V	Speciation and domestication–The process of speciation, Reproductive isolation barriers ; Genetic differentiation during speciation ; Hybridization - speciation and extinction; Exploitation of natural variation : Early attempts to increase variation, Distant hybridizationand introgression, Inter-specific, inter-generic hybridization, scope and limitations, techniques to overcome the limitations; Gene transfer into cultivated species, tools and techniques; Validation of transferred genes and their expression; Controlled introgressions	

VI	Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographicalindications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.	
VII	Mating systems, Random mating population, Nonrandom mating: selfing – inbreeding coefficient, panmictic index, sibmating , Assortative mating and disassortative mating; Pedigree populations and close inbreeding, Estimation of linkage disequilibrium , Correlation between relatives and estimation of F; Effect of inbreeding and sibbing in crosspollinated crops; Gene substitution and average effects; Breeding value- Genetic drift; Genetic slippage, Co-adapted gene complexes; Homoeostasis- Adaptive organization of gene pools; Polymorphism-Balanced and Non-balanced polymorphism, heterozygousadvantage- Survival of recessive and deleterious alleles in populations.	
VIII	**Sampling**: Concept of population and sample; random samples; methods of taking a simple random sample. Tests of significance: Sampling distribution of mean and standard error; z and t-test (equality of means; paired and unpaired t-test); t-test for comparison of means when variances of two populations differ; Chi- square test for goodness of fit; independence of attributes, and homogeneity of samples; interrelation between t-test and F-Test **Experimental Designs:** Principles of experimental designs; completely randomized, randomized complete block design (missing plot value in RBD); latin square designs; augmented block design; simple factorial experiments (mathematical derivations not required); analysis of variance (ANOVA) and its use including estimation of LSD (CD)	