

RAJASTHAN PUBLIC SERVICE COMMISSION

Syllabus for screening test for the Post of Agriculture Research Officer (Agriculture Botany) Agriculture Department

Cytology: Cell and cell division (Mitosis and meiosis), structural and functional organization of chromosomes, chromatin organization, nucleosome solenoid model, structural and numerical alterations in chromosomes, structure and properties of nucleic acid, bioenergetics.

Physiology: Photosynthesis and respiration, plant nutrients, plant water relationships.

Genetics : Modifications of Mendelian ratios, polygenic inheritance, linkage detection and three point test cross, cytogenetics of aneuploids and structural heterozygotes, fundamentals of molecular genetics, genetic material in organisms, Gene structure and expression, mechanism of recombination in prokaryote, genetic code, protein synthesis and gene regulation in prokaryotes and eukaryotes, RNA splicing, DNA repair mechanism, transposable elements, pseudogenes, overlapping genes, oncogenes, gene silencing, denaturation and renaturation of DNA, genomics, proteomics.

Mendelian population, random mating population, Hardy-Weinberg equilibrium, nature of gene action and linkage effects, principles of Analysis of Variance (ANOVA), experimental designs for plant breeding experiments, random and fixed effect models, comparison of means and variances for significance, genetic diversity analysis (Cluster and D^2), phenotypic and genotypic correlations, path analysis, selection indices, heritability and genetic advance, regression analysis including parent-progeny regression, generation mean analysis, mating designs (diallel, partial diallel, line x tester analysis, NCDs and TTC), concept of combining ability and gene action, GxE interaction and stability analysis, AMMI analysis, germplasm documentation.

Plant Breeding: Pre and post-Mendelian era of plant breeding, objective of plant breeding, characteristics improved by plant breeding, Pattern of evolution in crop plants, centre of origin-biodiversity and its significance, genetic basis of breeding self and cross pollinated crops including mating systems and response to selection, nature of variability, components of variation; Heritability and genetic advance, genotype-environmental interaction, general and specific combining ability, types of genes action and implication in plant breeding, Plant introduction and role plant genetic resources in plant breeding. Pure line theory, pure line

selection and mass selection methods, line breeding, pedigree, bulk, backcross, single seed descent and multiline method, population breeding in self pollinated crops, breeding method in cross pollinated crops, population breeding mass selection and ear-to-row methods, S₁ and S₂ progeny testing, progeny selection schemes, recurrent selection scheme for intra and inter population and improvement and development of synthetics and composites, Hybrid breeding-genetical and physiological basis of heterosis and inbreeding, population of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance, seed production of hybrid and their parent varieties/inbreds, breeding methods in asexually/ clonally propagated crops, clonal selection apomixes, clonal selection, self-incompatibility and male sterility in crop plants and their commercial exploitation, Concept of plant ideotype and its role in crop improvement.

Plant genetic resources and seed technology: Germplasm introduction & exchange, principles of in vitro and cryopreservation, germplasm conservation *in-situ*, *ex-situ* and on farm. Short, medium, long term conservation strategies of seed, plant genetic resources for food & agriculture, PGR and benefit sharing, IPR, PBR, UPOV, CBD and PPV&FR, seeds act and law enforcement, new seed act seed policy, variety development, release and notification, objectives & principals of seed production, categories of seed, maintenance breeding & seed production in cereals, pulses, oil seeds, fibre & forage crops, seed certification and seed standards, DUS testing

Biotechnology: Tissue culture techniques, introduction to vectors, their types and role in gene transfer, introduction to restriction enzymes, their types and role in gene transfer, techniques of DNA isolation, molecular mapping and tagging for agronomic traits, marker-assisted selection for quantitative and qualitative traits, QTLs analysis in crop plants, Marker assisted backcross breeding for rapid regression, gene pyramiding, recombinant DNA technology, transgenes, method of transformation, production of transgenic plants, gene transfer, DNA sequencing, biotechnological application in male sterility, MOs, GMO, international regulations and biosafety, bioinformatics, nanotechnology and its application.

Breeding (cereals, forages, oil seed and pulses): Evaluation and distribution, wild relatives and germplasm, breeding objectives and technology, biotic and abiotic stress, breeding for quality traits breeding achievements and future prospects of crop improvement with special reference to Rajasthan..

Mutation breeding: History, nature and classification, physical and chemical mutagens, molecular mechanism of mutation, effect of mutation on DNA, observing mutagen effect in M_1 and M_2 generations, use of mutagens in creating oligogenic and polygenic variations, use of mutagen in genomics, allele mining.

Heterosis breeding: Historical aspect and heterosis, heterosis in natural population and inbred population, Pre-Mendelian and Post-Mendelian ideas, genetic theories, prediction of heterosis, types of male sterility and use of heterosis breeding hybrid seed production system, development of parental lines, fixation of heterosis in self, cross and often cross pollinated crops, genetic engineering for creating male sterility and its exploitation.

Pattern of question papers:

1. Objective type paper
2. Maximum marks : 100
3. Number of question : 100
4. Duration of paper : Two hours
5. All question carry equal marks
6. There will be negative marking.
