Chhatrapati Shahu Ji Maharaj University, Kanpur

Answer Script Details
Barcode 12485454

Roll No. 25088000033
Total Mark 39/50.00

Exam Master of Science (Agriculture)(HORTICULTURE)_ODD
Subject MHORT5009 - BREEDING OF HORTICULTURE CROPS

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	4/5						
1B	4/5						
1C	4/5						
1D	4/5						
1E	3/5						
1F	4/5						
2	0/10						
3	0/10						
4	8/10						
5	0/10						
6	0/10						
7	0/10						
8	8/10						
9	0/10						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-I

Date of Exam: 10/12/25 Shift: Ist Room No.: 103
Paper Code: MHORT5009 Subject: Bsc of Hort Year/Sem.: IIIrd sem
Name of Candidate: MOH ASIF
Roll No.: 2508800033

Signature of Candidate
Signature of Invigilator
COE Facsimile

PART-II

MARKS OBTAINED

Q.	1	2	3	4	5	6	7	8	9	10
(a)										
(b)										
(c)										
(d)										
(e)										
(f)										
(g)										
(h)										
(i)										
(j)										
Total										

Total Marks in Figures — Max. Marks
Total Marks in Words

MHORT5009
Paper Code

Signature of Evaluator

PART-III

Course: M.Sc (Ag) [Horticulture]
Session: 2025-26 Year/Semester: IIIrd sem
Subject: Breeding of Hort Crops

Paper Code: MHORT5009
Exam Date: 10/12/2025
Name of Candidate: MOH ASIF
Father's Name: MD RASHID

महाविद्यालय का कोड College Code: EW02
परीक्षा केन्द्र का कोड Exam Centre Code: EW02

परीक्षा का प्रकार Type of Exam
Regular ● Ex. Student ○
Private ○ Back paper Exam ○

ANSWER BOOKLET NO.: 12485454

MHORT5009
Paper Code

Enrollment Number: CSJMA20013255549

Candidate's Roll Number: 2508800033

Paper Code: Ag5009

Signature of Candidate

10/12/25

परीक्षा केन्द्र-EW02

C.S Facsimile

COE Facsimile

नोट : 1. परीक्षार्थी को निर्देशित किया जाता है कि आवरण पत्रों के मुख पृष्ठ पर अंकित सभी निर्देशों को सावधानी पूर्वक पढ़ें।
2. बॉक्स में सभी जगह सभी प्रविष्टियाँ काली स्याही से भरें। 3. पेंसिल को काले या नीले बॉलपेन से भरा जाये।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-III

1. Use blue or black ball point pen for writing alphabets & numerals in ☐ Boxes.
2. Carefully study the example before you start marking.
3. As shown in the example below blacken the circles completely.

4. Make no Stray marks on this sheet.
5. **DO NOT WRITE OR MARK ON THE BAR CODE.**

IN ORDER TO AVOID UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/ electronic watch and any other electronic gadget except memory less scientific calculator shall be considered as UFM case.
4. Do not keep or paste currency note in answer script it shall be consider as UFM.

अनुचित साधन से बचने हेतु:

1. उत्तर पुस्तिका के निर्देशित स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कहीं और न लिखें तथा कोई भी चिन्ह न बनायें क्योंकि यह अनुचित साधन प्रयोग की परिधि में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेड़ करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में निम्न वस्तुएं साथ न लायें, जैसे लिखे हुए कागज के टुकड़े, मोबाईल, डिजिटल डायरी, कोपी, पुस्तक यह सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल सांकेतिक प्रश्नपत्र में ही मेमोरी लैस साइंटफिक कैल्कुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में रबपे न रखें न ही उत्तर पुस्तिका में चिपकायें। ऐसा करना अनुचित साधन प्रयोग की परिधि में आता है।

परीक्षार्थी के लिए निर्देश

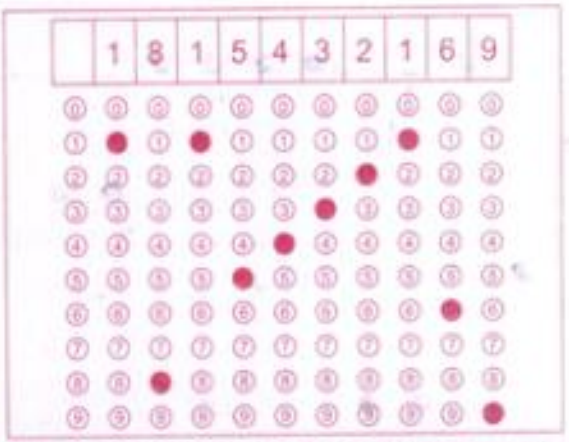
1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र कोड सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में पृष्ठ (1–24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. प्रश्नपत्र को देख, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा प्रश्न में कोई त्रुटि है तो उसके परीक्षा शुरू होने के 30 मिनट के अन्दर कक्ष निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कोई कार्यवाही नहीं की जायेगी।
9. प्रश्नों के उत्तर लिखने के लिये पैंसिल का प्रयोग न करें।
10. B कोपी या अतिरिक्त शीट नहीं दिया जायेगा।

INSTRUCTIONS TO THE CANDIDATE

1. Read the instructions carefully given on the Question Paper Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-32) or any other kind of damag in your answer script, if found than change the answer scri immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e.g Subject Code. Subject Name and Question of the Questio Paper during first THIRTY MINUTES of the commencement the exam, so that it can be corrected in TIME. After that n corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over paper should fill in status as Carry Over. Those appearing as E Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provided.

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-IV

1. Use blue or black ball point pen for writing alphabets & numberals in ☐ Boxes.
2. Use blue or black ball point pen for filling the circles.



Note - If your Roll No. is of 10 digits. Please leave first three column

Paper Code

MHORTS009

01

Section - A

Ans of Que - 1 (A)

-:- Parthenocarpy -:-

The term Parthenocarpy is derived from greek language 'Parthenos' means 'Virgin' & 'Karpos' means 'fruit'. The Parthenocarpy was first introduced by Noll in 1902.

Definition — Naturally or artificially induced production of fruits without fertilization of ovule making the fruit seedless is called Parthenocarpy.

Types of Parthenocarpy — 3 types based on Pollination

1. Vegetative Parthenocarpy — This type of Parthenocarpy takes place without pollination. Due to absence of pollination no seeds produced within fruits.
   eg. Seedless cucumber, Tea, Fig, Banana

2. Stimulative Parthenocarpy — When the fruits develop from the stimulation of pollination but without fertilization is called Stimulative Parthenocarpy.
   eg. Seedless watermelon, Papaya, Litchi

3. Stenospermo Parthenocarpy — When pollination & fertilization both takes place but embryo get aborted subsequently called stenospermo parthenocarpy.
   eg. Grapes, Guava, Orange etc.

Do not write anything in this portion

Ans of Qs - 1(B)

-:- Selection -:-

It is a basic process in the crop improvement of any crop.
"Isolation of desirable character plants from a population is called selection."

Types of selection — 2 types broadly

1. Pure Line Selection (PLS) — The concept of Pure line was given by Johnson in 1903 on the 'Princess' variety of Beans.
" A pure line is a single homogenous progeny of a self pollinated crop."

Method — PLS मे उत्कृष्ट लक्षण वाले कई पौधो का चयन किया जाता है। चयनित पौधो के बीजों को अलग-अलग एकत्र किया जाता है। अब इन बीजो के अलग-2 एकल पादप संततियो को उगाते है तथा उत्तम एकल पादप संतति को नई किस्म के रूप मे विमोचित करते हैं। इसमे लगभग 7-9 वर्ष [illegible] लगता है।

2. Mass selection — यह चयन की सबसे प्राचीन, सरल व सही विधि है। इसे "Broad breeding" या German method भी कहते है। इस विधि मे समान तथा उत्कृष्ट लक्षण प्रदर्शित करने वाले पौधो का चयन किया जाता है। इन पौधो के बीजों के मिश्रण से नई किस्म विकसित की जाती है। उत्पन्न नई किस्म के सभी पौधे दृश्य लक्षणों मे समान किन्तु आनुवंशिक लक्षणों मे भिन्न होते है।

Imp. vari selected from PLS — Pusa nakhudi (ohra), Pusa Deepali
Imp. vari selected from mass sele — Arka Jyoti, Arka sugun of muskmelon

Ans. of Qus — 1 (C)

—¦— Hybridization —¦—

When the crossing or mating of two plant or two lines of dissimilar genotypes is called Hybridization. Seeds as well as Progenies / Offsprings resulting from hybridization called F_1 or Hybrid.

Aims of Hybridization —

1. To create genetic variation
2. To develop transgressive segregation
3. Acclimatization of desirable characters in one spp.
4. To use hybrid vigour.

Methods of Hybridization —

1. Pedigree method — Individuals are selected from F_2 & subsequent generation & their progeny are tested during entire process a record of offspring ; Parent relation ship is kept called Pedigree record.

2. Bulk method — F_2 & subsequent generation are harvested in bulk as mass to raise next generation. At the bulking point after attaining homozygosity Individual are selected & same similar to Pedigree method. This method was proposed by Nilsson Ehle in 1908.

3. Back cross — This method was proposed by Harlan & Pope in 1922.
"Often a cross in order b/w F1 hybrid to one of his parents called back cross."

Examples of Varieties released from hybridization —

Okra — Arka Anamika, Arka Abhay, Arka Nikita.
Tomato — Arka Vishal, Arka Vardan, Rajkumar
Mango — Arka Puneet, Arka Aruna, Mallika, Amrapali
Papaya — CO-3, CO-4, CO-5

Ans of Q48 – 1 (D)

Nematode resistant varieties of Brinjal —

Root knot Nematode which is scientifically known as 'Meloidogyne incognita' or 'M. javanica' is a serious pest of Solanaceae family crops & mostly observed in Brinjal, Tomato, Chilli etc. Plants affected from this pest show stunted growth & soon wilted & die.

There are some varieties of Eggplant which show resistant or tolerance to Root knot Nematode. —

1 Arka Nidhi

Paper Code M H S K T S 009

2. Arka kusmakar
3. Pusa purple cluster
4. Pusa hybrid – 6
5. Raivayya (local cultivar)
6. Pala (local cultivar)
7. Janak (local cultivar)
8. Annamalai (local cultivar)
9. F_1 hybrid of IIHR 824 × IIHR 766
10. F_1 hybrid of IIHR 824 × IIHR 356
11. F_1 hybrid of IIHR 824 × IIHR 835

Besides the varieties there are some rootstock or wild relatives which show resistance or tolerance to R.K.N. —

1. Solanum torvum : This rootstock show high resistance against M. incognita & M. javanica both spp.

2. Solanum khasianum : Provide good source of resistance & strong root system.

3. S. sysimbriifolium : It is wild ancestor of egg plant. Its accession SIS-1 show tolerance to RKN.

4. Pre breeding line — Pre breeding line of S. incanum F2-10 shows a moderate tolerance against RKN.

Paper Code: MHORTS003

06

Ans of Q6 - 1 (E)

	Particulars	Cultivars	Varieties
1.	Origin	Developed by human involvement either by selective breeding or genetic modification	occurs naturally in wild due to natural selection within spp.
2.	Genetic makeup	Genetically identical for specific trait selected by breeder eg size or disease	Genetically diverse from parent plants
3.	Genetic diversity	Low to moderate depend on breeding related	High diversity
4.	Propagation	Both sexually & asexually to maintain desirable character	Sexually by seeds as the seeds carry natural diversity.
5.	Human involvement	High due to asexual propagation	Low as naturally occurs
6.	Purpose	To produce plants identical for specific desired characters viz- size, yield disease resistance	They are naturally occuring subgroups used by breeders to create new cultivars

Paper Code MHORTS069 07

Ans of Qs- 1 (F)

Breeding objectives of Papaya —

Each and every commercial cultivar of any crop has some merits & demerits which requires to improve by improved breeding methods. Following are the important breeding objectives of Papaya—

1. High yielding with good quality fruit.
2. Early maturity of fruit.
3. Desirable fruit shape, size & colour as per consumer preference.
4. To develop varieties with low seed cavity index
5. High pulp consistency varieties.
6. Good keeping quality
7. High latex yield
8. Suitable for export & transportation.
9. Suitable for Processing purpose
10. Induction of seedlessness.
11. Breeding for disease resistance: Damping off
   Leaf spot
   Papaya leaf curl virus
   Papaya mosaic virus.
12. Breeding for insect resistance: White fly
   Aphid
   Fruit fly
13. Breeding for abiotic stress resistance
   Drought, Frost, High & low temp etc.

Section – B

Ans of Q48 – 4

Breeding objectives & Methods of okra —

B.N – Abelmoschus esculentus
Family – Malvaceae
2n – 130 (Amphidiploid)
origin – Tropical & Subtropical Africa
Fruit type – capsule
Pollination – often cross pollination

- Genetic resource — Genetic resource of okra is being maintaining at NBPGR, New Delhi. The prime objective for maintaining germplasm is to isolate the source of resistance to Y.V.M.V.

- Wild relatives — There are more than 30 spp under genus Abelmoschus in old world & few spp. in new world. Abelmoschus esculentus is only the cultivated spp. of okra. A. manihot is also a cultivated spp. at limited scale in Africa.

A. angulosus – 2n = 56
A. abroculatus – 2n = 58
A. manihot – 2n = 66
A. moschatus – 2n = 72

- Breeding objective — Following are the objective for which breeding is applied.

1. High productivity with dark green oblong fruits
2. Earliness of fruits
3. Resistance to Y.V.M.V, leaf spot, Powdery mildew, downy mildew.
4. Combine resistance to Y.V.M.V with Fruit & shoot borer, white fly etc
5. Suitable ideotype
6. Suitable for processing & export.
7. Induced the early maturity
8. Wider ecological adaptability
9. Elimination of toxic substance.

- Breeding methods —

1. Introduction : 'Pusa makhmale' was an introduced cultivar widely cultivated in Okra commercial cultivation.
2. Pure line selection : Some spp. of okra was developed through Pure line selection. For example

'Pusa makhmali' was a breed developed from material collected from W. Bengal.
'CO-1' from Red wonder.

3. Pedigree selection : Mostly cultivars developed in okra by pedigree method.
eg. Pusa sawni
Punjab padmini
Arka anamika
Arka abhay
Parbhani Kranti

4. Mutation : Mutation are sudden inheritable changes in the genetic makeup that is not due to segregation & recombination.
In the okra two varieties developed through mutation.

Mutant	Parent
Punjab 8 / EMS-1	Pusa sawni
MDU-1	Pusa sawni

5. Heterosis / Hybridization : Heterosis observed in okra for various economic traits viz early / late fruiting, Plant height, size, weight & number of pods / plant, Total yield of crop etc.

Important hybrids — Kashi Mohini
Kashi Pragati

Paper Code

M H O R T S 0 0 9

11

Kashi lalima (Sarnath Varanasi)
Kashi bhairav
Kashi mahima
Vrish
Vijya → C.S.A Kanpur
Vaishali

Kashi series varieties were devloped from BHU, Baranas.

Varietal acheivement —

1. Early maturity : EC 128062, EC 329370

2. Res. to damping off & Rhizoctonia solani : Red glara, BR-27

3. Res. to Powdery mildew : A. angolensis, A. ~~tetraphyles~~

4. Res. to fusarium wilt : Pusa sawani, Pusa makhmali

5. Tolerent to Mites : A. angolensis

6. Res. to Y.V.M.V : Parbhani kranti
Varsha uphar
Punjab padmini
Arka anamika
Arka abhay
Pusa sawani

Do Not Write anything in this Portion

Paper Code: MHORTS009

Section - C

Ans of Que - 8

-|- Mango Crop improvement -|-

A. Botanical classification —

B.N - *Mangifera indica*
Family - Anacardiaceae
Origin - Indo - Verma
2n - 2x = 40
Fruit type - Drupe
Edible part - Mesocarp
Pollination — Cross pollination

B. Germplasm resource - India is the house of mango germplasm. In India more than 1000 var. spp. of mangoes are grown. CISH, Lucknow has the largest collection of mango germplasm. Further germplasm is being maintained at IARI, IIHR (Banglore), Sabour (Bihar), R.F.S Sangareddy (Andhra pradesh) etc

Allied spp of mango:
M. sylvatica — Indo Burma
M. caloneura — Burma
M. odorata — Malaya
M. merandra — Phillippines
M. macrocarpum — Malaya

C. Breeding objectives of Mango —

1. High yielding varieties.
2. Dwarf growing habit.
3. Precocity & Regular bearing varieties eg. Neelum, Gulabkhas, Himsagar, Totapori.
4. Attractive fruit color with pleasant aroma
5. Good quality
6. Suitable for export trade eg. Alphonso
7. Suitable for Processing purpose.
8. Breeding for abiotic stress eg. Drought
   Soil salinity
   Frost
   Extreme / low temp.
9. Breeding for biotic stress eg. Disease res. Powdery mildew, Anthracnose, Bacterial wilt, ~~Leaf Spot~~ Leaf spot etc.
10. Breeding for Insect resistance eg. Mango hopper, Mango Mealy bug, Fruit fly etc.
11. Breeding for physiological disorder res. eg. Alternate bearing, Mango malformation, Spongy tissue,

Thrink (clustering of flowers) etc.

D. Breeding methods & achievements —

1. Introduction — Many cultivars of mango were introduced from different mango growing countries.

Cultivar	Country
Tommy, Haden, Sensation, Julie	Florida (USA)
Beauty	Thailand
Amable	Belgium

2. Selection — Most of currently cultivated cultivars of mango were developed through open pollination seedling selection.
For eg. Dashehari, Langra, Chausa. etc.

3. Clonal selection — A few elite clones were developed through clonal selection.

Clones	Remarks	Parent
Dashari-51	Regular bearing	Dasheri
Subhash	Zardalu	A chance seedling sel.
Langra & Ramsagar	High yielding	—
Rumani & neelum	Superior clone	—
Paiya-1	HDP	Neelum
Niranjan	off season	-

4. Hybridization — Hybridization in mango laid emphasis on precocity & regular bearing, High percentage of pulp, Fibreless flesh, Large size fruits with red blush, Good keeping quality & free from spongy tissue.

A few examples of hybrids are following —

• Developed from IARI —

1. Prabhashankar : Bombay green x kalapady, is considered first hybrid.

2. Mallika : Neelum x Dashehari, High Vit A content

3. Amrapali : Dashehari x Neelum, For H.D.P

• From IIHR (Banglore) —

1. Arka aruna : Banganpalli x Alphonso
2. Arka puneet : Alphonso x Banganpalli
3. Arka anmol, Arka neelkiran etc

• RFRS Vengurla —

1. Sindhu — Ratna x Alphonso (Stone free var.)
2. Ratna — Neelam x Alphonso

• CISH — Ambika

• AES Paria — Neelphanso

5. Mutation — Only natural mutation

Mutant	Parent
Davis Haden	Haden
Rosica	Rosada da Ica

6. Polyploidy breeding — 'Vaibicolamban' a tetraploid cultivar having 2n=4x=80 developed in mango.

7. Heterosis — Iyer & Subramanyam (1981) observed large size fruits in the progeny of Alphonso x Banganpalli

Paper Code

X

Do Not Write anything in this Portion

Paper Code

19

X

Paper Code

20

Do Not Write anything in this Portion

X

Paper Code

22

Do Not Write anything in this Portion

Paper Code

23

X

Do Not Write anything in this Portion