GURU NANAK COLLEGE, BUDHLADA

Under the management of S.G.P.C. Sri Amritsar Sahib
Affiliated with Punjabi University, Patiala & Approved by AICTE

Course File

B.Sc (Hons) Agriculture III Year Semester-V

GPB 301- Crop Improvement

Department of Agriculture

Name of Teacher	:	**Dr. Sarvan Kumar**
Designation	:	**Assistant Professor**
Department	:	**Agriculture**
Subject	:	**Crop Improvement**
Joining date	:	**14-12-2016**
SESSION FROM	:	**Sep TO Dec 2021**

B.Sc. (Hons) Agriculture-III SEM-V 2021-22 (Odd semester)
Guru Nanak College Budhlada (Room No. 69 Basement)

Class / Time	09: 30-10.10 (I)	10:10-10:50 (II)	10:50-11:30 (III)	11:30-12.10 (IV)	12.10-12:50 (V)	12:50-01:30 (VI)	01:30-2.10 (VII)	02:10-2.50 (VIII)
Monday	STAT 301 Statistical Method **(Amanpreet Kaur)**	**PATH 301** Disease of horticulture crop and their management **(Ms. Sushampreet Sharma)**	**HORT 301** Production technology for ornamental crops and land scaping **(Ms. Sumandeep kaur)**	**FSM 301** Principles of food science and post harvest management **(Er. Dilip Kumar Ojha)**	**GPB-301** Crop Improvement **(Dr. Sarvan Kumar)**	**EXT 301** Fundamental of Agriculture extension **(Er. Dilip Kumar Ojha)**	**BIOT-301** Introduction to biotechnology **(Ms. Kanchan Kumari)**	
Tuesday	-do-	-do-	-do-	-do-	-do-	-do-	-do-	
Wednesday	-do-	-do-	-do-	-do-	Field Activity	-do-	do	
Thursday	-do-	Field Activity	do	-do-	**GPB-301** Crop Improvement **(Dr. Sarvan Kumar)**	-do-	**PATH 301** Disease of horticulture crop and their management **(Sushampreet Sharma)**	
Friday	**STAT 301** Statistical Method Practical **(Amanpreet Kaur)**	**EXT 301** Fundamental of Agriculture extension Practical **(Er. Dilip Kumar Ojha)**		Field Activity	**FSM 301** Principles of food science and post harvest management Practical **(Er. Dilip Kumar Ojha**		**HORT 301** Production technology for ornamental crops and land scaping Practical **((Sumanpreet kaur**	
Saturday	do	Practical **BIOT-301** Introduction to biotechnology **(Ms. Kanchan Kumari)**		**PATH 301** Disease of horticulture crop and their management Practical **(Dr. Sarvan Kumar)**		Practical **GPB-301** Crop Improvement **(Dr. Sarvan Kumar)**		

HOD **Principal**

Time Table Session 2021-22 B.Sc. (Hons) Agriculture (Odd semester)
Guru Nanak College, Budhlada
B.Sc (Hons) Agri –III Sem-V

Time / Day	09:30-10:10	10:10-10:50	10:50-11:30	11:30-12:10	12:10-12:50	12:50- 1:30	1:30-2:10	2:10-2:50	2:50-3:20
	1st	2nd	3rd	4th	5 th	6 th	7 th	8 th	9th
Monday					**GPB-301** Crop Improvement **(Dr. Sarvan Kumar)**				
Tuesday					**GPB-301** Crop Improvement **(Dr. Sarvan Kumar)**				
Wednesday					Field Activity of crop improvement				
Thursday					**GPB-301** Crop Improvement **(Dr. Sarvan Kumar)**				
Friday									
Saturday						Practical **GPB-301** Crop Improvement **(Dr. Sarvan Kumar)**			

Summary

Class	BSc.(Hons) Agri-III Sem-V
Subject	**GPB301 Crop Improvement**
No. of Periods	06

PUNJABI UNIVERSITY, PATIALA
Scheme of Studies and Syllabus for
B.Sc. (Hon's in Agriculture) PART-III (Semester-V & VI)
Session: 2020-21, 2021-22 & 2022-23

SEMESTER-V

GPB-301 CROP IMPROVEMENT

Max Marks: 100
Theory: 45 Practical: 40
Internal Assessment: 15 Pass Marks : 40% in Theory & Practical Separately

THEORY

Duration of the paper: 3 Hours **Max Marks: 45** **Pass marks: 40%**

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus. Each question from Section A will carry 6.5 marks while each question from Section B will carry 7 marks. Section C will consist of 9 short-answer (8-10 lines) type questions of 2 marks each and will cover the entire syllabus uniformly.

INSTRUCTIONS FOR CANDIDATES

The Candidates are required to attempt two questions from each section A and B and the entire section C.

SECTION A

1. Centers of origin, distribution of species, wild relatives, Floral biology in cereals and pulses-Wheat, Rice, pigeon pea and chick pea.
2. Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters.
3. Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops.

SECTION B

4. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids varieties.
5. Adaptability, stability, abiotic and biotic stress tolerance. Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crops.
6. Hybrid seed production technology in cereals and pulses.
7. Ideotype concept and climate resilient crop varieties for future.

GPB-301 CROP IMPROVEMENT

PRACTICAL

Max. Marks : 40 **Pass Marks: 40%** **Duration of the Paper: 3 Hours**

1. Emasculation and hybridization techniques in different field crop species; viz., Wheat, Paddy, Gram Maize, Cotton, Cowpea, Pearl millet and Tobacco.
2. Maintenance breeding of different kharif crops.
3. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods
4. Study of field techniques for seed production and hybrid seeds production in *Kharif* crops
5. Estimation of heterosis, inbreeding depression and heritability
6. Layout of field experiments; Study of quality characters, donor parents for different characters;
7. Visit to seed production plots
8. Visit to ICAR/SAU of different field crops.

BOOK READING

1. Hayes, Immar & Smith : *Methods of Plant Breeding*
2. Poehlhlman J.M. & : *Breeding of Asian Field Crops*
3. Borthakur
4. Singh B.D. : *Plant Breeding- Principles and Methods*
5. *Singh B.D* : *A Text book of Plant Breeding*
6. *Singh Phundan* : *Essentials of Plant Breeding*
7. *Chahal G.S and Gosal S.S* : *Principles and procedure of Plant Breeding, Biotechnological and conventional approaches*

Monthly Syllabus plan Theory and Practical
Department of Agriculture
Guru Nanak College, Budhlada (Mansa)

Monthly Syllabus Coverage of B.Sc. (Hons) Agri-III Sem-V during Sep 2021 to Dec 2021 (Dr. Sarvan Kumar)				
Month	Class	Subject	**Topics**	**Methods & Teaching Aids used**
September	B.Sc (H) Ag. –III sem	Crop Improvement (Theory)	❖ Centers of origin, distribution of species wild relatives ❖ Floral biology in cereals and pulses-Wheat, Rice, pigeon pea and chick pea. ❖ Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters ❖ Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops	PPT & Black board
October	B.Sc (H) Ag. –III sem	Crop Improvement (Theory)	❖ Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops. ❖ Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids varieties. ❖ Adaptability, stability, abiotic and biotic stress tolerance	PPT & Black board
November	B.Sc (H) Ag. –III sem	Crop Improvement (Theory)	❖ Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop ❖ Hybrid seed production technology in cereals and pulses.	PPT & Black board
December	B.Sc (H) Ag. –III sem	Crop Improvement (Theory)	❖ Ideotype concept and climate resilient crop varieties for future.	PPT & Black board

Teacher **HOD** **Principal**

Monthly Syllabus Coverage of B.Sc (Hons) Agri-III Sem-V during Sep 2021 to Dec 2021
(Dr. Sarvan Kumar)

Month	Class & section	Subject	Topics	Methods & Teaching Aids used
September	B.Sc (H) Ag. – III Sem-V	Crop Improvement (Practical)	❖ Emasculation and hybridization techniques in different field crop species; viz., Wheat, Paddy, Gram Maize Cotton, Cowpea, Pearl millet and Tobacco ❖ Maintenance breeding of different Kharif crops.	Field demonstration PPT & Black board
October	B.Sc (H) Ag. – III Sem-V	Crop Improvement (Practical)	❖ Study of field techniques for seed production and hybrid seeds production in Kharif crops ❖ Estimation of heterosis, inbreeding depression and heritability	PPT & Black board
November	B.Sc (H) Ag. – III Sem-V	Crop Improvement (Practical)	❖ Layout of field experiments; Study of quality characters, donor parents for different characters ❖ Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods	PPT & Black board
December	B.Sc (H) Ag. – III Sem-V	Crop Improvement (Practical)	❖ Visit to seed production plots at campus demonstrated by students	

Teacher **HOD** **Principal**

Weekly Syllabus plan Theory and Practical

Department of Agriculture

Guru Nanak College, Budhlada (Mansa)

Syllabus Coverage of B.Sc. (Hons) Agri-III Sem-V during Sep 2021 to Dec 2021 (Dr. Sarvan Kumar)		
DATE	**Topics**	**Methods & Teaching Aids used**
1 Sep 21	Centers of origin, distribution of species wild relatives	PPT & Black board
2 Sep 21	Centers of origin, distribution of species wild relatives	PPT & Black board
6 Sep 21	Centers of origin, distribution of species wild relatives	PPT & Black board
8 Sep 21	Centers of origin, distribution of species wild relatives	PPT & Black board
9 Sep 21	Centers of origin, distribution of species wild relatives	PPT & Black board
13 Sep 21	Floral biology in cereals and pulses-Wheat, Rice, pigeon pea and chick pea.	PPT & Black board
15 Sep 21	Floral biology in cereals and pulses-Wheat, Rice, pigeon pea and chick pea.	PPT & Black board
16 Sep 21	Floral biology in cereals and pulses-Wheat, Rice, pigeon pea and chick pea	PPT & Black board
20 Sep 21	Floral biology in cereals and pulses-Wheat, Rice, pigeon pea and chick pea.	PPT & Black board
21 Sep 21	Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters	PPT & Black board
22 Sep 21	Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters	PPT & Black board
23 Sep 21	Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters	PPT & Black board
28 Sep 21	Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops	PPT & Black board

29 Sep 21	Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops	PPT & Black board
30 Sep 21	Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops	PPT & Black board
04 Oct 21	Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops.	PPT & Black board
5 Oct 21	Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops.	PPT & Black board
6 Oct 21	Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops.	PPT & Black board
11 Oct 21	Important concepts of breeding self-pollinated cross-pollinated and vegetatively propagated crops.	PPT & Black board
12 Oct 21	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids varieties	PPT & Black board
13 Oct 21	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids varieties	PPT & Black board
14 Oct 21	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids varieties	PPT & Black board
18 Oct 21	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids varieties	PPT & Black board
19 Oct 21	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids varieties	PPT & Black board

21 Oct 21	Adaptability, stability, abiotic and biotic stress tolerance	PPT & Black board
25 Oct 21	Adaptability, stability, abiotic and biotic stress tolerance	PPT & Black board
26 Oct 21	Adaptability, stability, abiotic and biotic stress tolerance	PPT & Black board
27 Oct 21	Adaptability, stability, abiotic and biotic stress tolerance	PPT & Black board
28 Oct 21	Adaptability, stability, abiotic and biotic stress tolerance	PPT & Black board
1 Nov 21	Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop	PPT & Black board
2 Nov 21	Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop	PPT & Black board
3 Nov 21	Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop	PPT & Black board
8 Nov 21	Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop	PPT & Black board
9 Nov 21	Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop	PPT & Black board
10 Nov 21	Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop	PPT & Black board
11 Nov 21	Seed production technology in self-pollinated, cross-pollinated and vegetative propagated crop	PPT & Black board
15 Nov 21	Hybrid seed production technology in cereals and pulses.	PPT & Black board
17 Nov 21	Hybrid seed production technology in cereals and pulses.	PPT & Black board
23 Nov 21	Hybrid seed production technology in cereals and pulses.	PPT & Black board

24 Nov 21	Hybrid seed production technology in cereals and pulses.	PPT & Black board
25 Nov 21	Ideotype concept and climate resilient crop varieties for future.	PPT & Black board
29 Nov 21	Ideotype concept and climate resilient crop varieties for future.	PPT & Black board
30 Nov 21	Ideotype concept and climate resilient crop varieties for future.	PPT & Black board
01Dec 21	Ideotype concept and climate resilient crop varieties for future.	PPT & Black board
02 Dec 21	Ideotype concept and climate resilient crop varieties for future.	PPT & Black board
06 Dec 21	Ideotype concept and climate resilient crop varieties for future.	PPT & Black board

Weekly Syllabus plan Practical

Department of Agriculture

Guru Nanak College, Budhlada (Mansa)

Syllabus Coverage of B.Sc. (Hons) Agri-III Sem-V during Aug 2021 to Dec 2021 (Dr. Sarvan Kumar)		
DATE	**Topics**	**Methods & Teaching Aids used**
4 Sep 21	Emasculation and hybridization techniques in different field crop species; viz., Wheat, Paddy, Gram Maize Cotton, Cowpea, Pearl millet and Tobacco	PPT and field practices
11 Sep 21	Emasculation and hybridization techniques in different field crop species; viz.	PPT and field practices
18 Sep 21	Emasculation and hybridization techniques in different field crop species; viz.	PPT and field practices
25 Sep 21	Maintenance breeding of different Kharif crops.	PPT & Black board
02 Oct 21	Study of field techniques for seed production and hybrid seeds production in Kharif crops	PPT & Black board, Field demonstration
9 Oct 21	Study of field techniques for seed production and hybrid seeds production in Kharif crops	PPT & Black board, Field demonstration
16 Oct 21	Study of field techniques for seed production and hybrid seeds production in Kharif crops	PPT & Black board, Field demonstration
23 Oct 21	Estimation of heterosis, inbreeding depression and heritability	PPT & Black board

30 Oct 21	Estimation of heterosis, inbreeding depression and heritability	PPT & Black board
6 Nov 21	Layout of field experiments; Study of quality characters, donor parents for different characters	PPT & Black board
13 Nov 21	Layout of field experiments; Study of quality characters, donor parents for different characters	PPT & Black board
20 Nov 21	Handling of germplasm and segregating populations by different methods like Pedigree, bulk and single seed decent methods	PPT & Black board
27 Nov 21	Handling of germplasm and segregating populations by different methods like Pedigree, bulk and single seed decent methods	PPT & Black board
4 Dec 21	Assignment check	

Attendance Details

- Subject Title : **GPB -301 Crop Improvement (Theory)**
- Class/Section : **B.Sc (Hons) Agriculture-III (Sem-V)**
- Name of teacher : **DR SARVAN KUMAR**
- Session : **2021-22 (Sep 2021 to Dec 2021)**

Sr.	Regn. No.	Uni. Roll No.	Class roll no.	Name	Lectures attended (46)	%age of Attendance
1	5111-2019-1317	634901	9518	Sunil Rani	38	83
2	5111-2019-1316	634902	9546	Sandeep Kaur	36	78
3	5111-2019-1332	634903	9535	Riya	40	87
4	5111-2019-1303	634904	9504	Prabhdeep Kaur	32	70
5	5111-2019-1308	634905	9509	Mandeep Kaur	39	85
6	5111-2019-1334	634906	9540	Jyoti Kaur	36	78
7	5111-2019-1336	634907	9542	Babbli	35	76
8	5111-2019-1318	634908	9520	Yogesh	41	89
9	5111-2019-1327	634909	9529	Sukhwinder Singh	35	76
10	5111-2019-1310	634910	9511	Sukhpreet Singh	36	78
11	5111-2019-1314	634911	9515	Shiv Kumar	35	76
12	5111-2019-1305	634912	9506	Satgur Singh	36	78
13	5111-2019-1311	634913	9512	Satgur Singh	36	78
14	5111-2019-1325	634914	9527	Sandeep	37	80
15	5111-2019-1328	634915	9530	Sachin Singla	36	78
16	5111-2019-1319	634916	9521	Robin	38	83
17	5111-2019-1301	634917	9501	Ramandeep Singh	37	80
18	5111-2019-1302	634918	9502	Prabhdeep Singh	39	85
19	5111-2019-1351	634919	9545	Piyanshu Goyal	35	76
20	5111-2019-1329	634920	9531	Mohit Garg	36	78
21	5111-2019-1304	634921	9505	Maninder Singh	35	76
22	5111-2019-1307	634922	9508	Lovely	38	83
23	5111-2019-1324	634923	9526	Kuldeep Singh	36	78
24	5111-2019-1306	634924	9507	Jatinderpal Singh	35	76
25	5111-2019-1333	634925	9538	Jaswinder Singh	37	80
26	5111-2019-1331	634926	9534	Hardeep Singh	36	78
27	5111-2019-1309	634927	9510	Gurjeet Singh	35	76
28	5111-2019-1335	634928	9541	Gurdeep Singh	36	78

29	5111-2019-1321	634929	9523	Gurbhej Singh	40	87
30	5111-2019-1330	634930	9532	Gagandeep Singh	36	78
31	5111-2019-1313	634931	9514	Dilpreet Singh	35	76
32	5111-2019-1312	634932	9513	Arshjot Singh	35	76
33	5111-2019-1326	634933	9528	Arman Singh	35	76
34	5111-2019-1320	634934	9522	Amritpal Singh	36	78
35	5111-2019-1322	634935	9524	Amit Kumar	38	83

Teacher **HOD**

Attendance Details

- Subject Title : **GPB -301 Crop Improvement** (Practical)
- Class/Section : **B.Sc Agriculture-III (Sem-V)**
- Name of teacher : **DR SARVAN KUMAR**
- Session : **2021-22 (Sep 2021 to Dec 2021)**

Sr.	Regn. No.	Uni. Roll No.	Class roll no.	Name	Lectures attended (14)	%age of Attendance
1	5111-2019-1317	634901	9518	Sunil Rani	11	79
2	5111-2019-1316	634902	9546	Sandeep Kaur	11	79
3	5111-2019-1332	634903	9535	Riya	12	86
4	5111-2019-1303	634904	9504	Prabhdeep Kaur	11	79
5	5111-2019-1308	634905	9509	Mandeep Kaur	12	86
6	5111-2019-1334	634906	9540	Jyoti Kaur	11	79
7	5111-2019-1336	634907	9542	Babbli	11	79
8	5111-2019-1318	634908	9520	Yogesh	12	86
9	5111-2019-1327	634909	9529	Sukhwinder Singh	11	79
10	5111-2019-1310	634910	9511	Sukhpreet Singh	11	79
11	5111-2019-1314	634911	9515	Shiv Kumar	11	79
12	5111-2019-1305	634912	9506	Satgur Singh	11	79
13	5111-2019-1311	634913	9512	Satgur Singh	12	86
14	5111-2019-1325	634914	9527	Sandeep	11	79
15	5111-2019-1328	634915	9530	Sachin Singla	12	86
16	5111-2019-1319	634916	9521	Robin	11	79
17	5111-2019-1301	634917	9501	Ramandeep Singh	11	79
18	5111-2019-1302	634918	9502	Prabhdeep Singh	12	86
19	5111-2019-1351	634919	9545	Piyanshu Goyal	11	79
20	5111-2019-1329	634920	9531	Mohit Garg	11	79
21	5111-2019-1304	634921	9505	Maninder Singh	11	79
22	5111-2019-1307	634922	9508	Lovely	12	86
23	5111-2019-1324	634923	9526	Kuldeep Singh	11	79
24	5111-2019-1306	634924	9507	Jatinderpal Singh	11	79
25	5111-2019-1333	634925	9538	Jaswinder Singh	11	79
26	5111-2019-1331	634926	9534	Hardeep Singh	11	79
27	5111-2019-1309	634927	9510	Gurjeet Singh	11	79
28	5111-2019-1335	634928	9541	Gurdeep Singh	11	79
29	5111-2019-1321	634929	9523	Gurbhej Singh	12	86

30	5111-2019-1330	634930	9532	Gagandeep Singh	11	79
31	5111-2019-1313	634931	9514	Dilpreet Singh	12	86
32	5111-2019-1312	634932	9513	Arshjot Singh	11	79
33	5111-2019-1326	634933	9528	Arman Singh	11	79
34	5111-2019-1320	634934	9522	Amritpal Singh	12	86
35	5111-2019-1322	634935	9524	Amit Kumar	12	86

Teacher **HOD**

Internal Assessment

- **Subject Title : GPB -301 Crop Improvement**
- **Class/Section : B.Sc (Hons) Agriculture-III(Sem-V)**
- **Name of teacher : DR SARVAN KUMAR**
- **Session : 2020-21 (Dec 2021)**

Maximum Marks: 15

Sr.	Regn. No.	Uni. Roll	Name	Average two MST (6)	Assignment (6)	Attendance (3)	Marks obtained
1	5111-2019-1317	634901	Sunil Rani	4	5	3	12
2	5111-2019-1316	634902	Sandeep Kaur	4	5	3	12
3	5111-2019-1332	634903	Riya	5	6	3	14
4	5111-2019-1303	634904	Prabhdeep Kaur	4	5	3	12
5	5111-2019-1308	634905	Mandeep Kaur	5	5	3	13
6	5111-2019-1334	634906	Jyoti Kaur	5	5	3	13
7	5111-2019-1336	634907	Babbli	5	5	3	13
8	5111-2019-1318	634908	Yogesh	5	6	3	14
9	5111-2019-1327	634909	Sukhwinder Singh	4	5	2	11
10	5111-2019-1310	634910	Sukhpreet Singh	3	5	3	11
11	5111-2019-1314	634911	Shiv Kumar	4	5	2	11
12	5111-2019-1305	634912	Satgur Singh	4	5	3	12
13	5111-2019-1311	634913	Satgur Singh	4	5	3	12
14	5111-2019-1325	634914	Sandeep	4	5	3	12
15	5111-2019-1328	634915	Sachin Singla	4	5	3	12
16	5111-2019-1319	634916	Robin	5	5	3	13
17	5111-2019-1301	634917	Ramandeep Singh	4	5	3	12
18	5111-2019-1302	634918	Prabhdeep Singh	5	5	3	13
19	5111-2019-1351	634919	Piyanshu Goyal	4	5	2	11
20	5111-2019-1329	634920	Mohit Garg	4	6	3	13
21	5111-2019-1304	634921	Maninder Singh	4	5	3	12
22	5111-2019-1307	634922	Lovely	5	6	3	14
23	5111-2019-1324	634923	Kuldeep Singh	4	5	3	12
24	5111-2019-1306	634924	Jatinderpal Singh	4	5	3	12
25	5111-2019-1333	634925	Jaswinder Singh	5	5	3	13
26	5111-2019-1331	634926	Hardeep Singh	4	5	3	12
27	5111-2019-1309	634927	Gurjeet Singh	4	5	3	12
28	5111-2019-1335	634928	Gurdeep Singh	4	5	3	12
29	5111-2019-1321	634929	Gurbhej Singh	6	5	3	14
30	5111-2019-1330	634930	Gagandeep Singh	4	5	3	12
31	5111-2019-1313	634931	Dilpreet Singh	5	5	3	13
32	5111-2019-1312	634932	Arshjot Singh	5	5	3	13

33	5111-2019-1326	634933	Arman Singh	5	5	3	13
34	5111-2019-1320	634934	Amritpal Singh	5	5	3	13
35	5111-2019-1322	634935	Amit Kumar	4	5	3	12

Breakup of Internal Assessment for theory (According to RUSA guidelines) will be as under

Average of two mid –semester test: (6 marks 40%)

Assignment: (6 Marks 40%)

Attendance: (3 Marks 20%)

Teacher Sign. **HOD** **Principal**

Guru Nanak College, Budhlada Mansa (Punjab)

MST-Exam November 2021

B.Sc. (Hon) AGRICULTURE – III year (Sem-V)

SUBJECT CODE – GPB 301
Crop Improvement

Teacher name: Dr. Sarvan Kumar

Time Allowed: Three Hours] **[Maximum Marks: 45**

Candidate attempt any three question (12 Marks each)

Q.1 . Explain centre of origin of crops? Describe briefly primary and secondary centers of origins of crops.

Q.2 . Define plant genetic resources and explain different types of plant genetic resources.

Q.3 . Discuss conventional and non-conventional approach of plant breeding

Q.4 . Differentiate between traditional breeding and ideotype breeding

Q.5 . Differentiate between variety and hybrid.

Q.6 . Differentiate between quantitative and qualitative characters related to wheat

Q.7 Short note: (01 marks each)

I. IPGRI and NBPGR
II. ideotype breeding
III. A line, B line and R line system of hybrid seed production.
IV. Hybrid
V. Origin of wheat
VI. Back cross
VII. Recurrent selection
VIII. Top cross
IX. Types of hybrid in maize

B.Sc.(Hons. in Agriculture) PART — III (Sem-V)

MST-Exam –I Sep 2021

GPB-301: Crop Improvement

Teacher Name: Dr. Sarvan Kumar **Max Marks: 30**

Duration of the Paper: 1.5 Hour **Pass Marks: 40%**

INSTRUCTIONS FOR CANDIDATES

Attempt any two Question from section A and entire question attempt from section B

Section A (Attempt any two question carry 10 marks each)

Q.1: What is germplasm? Discuss in detail plant genetic resources, its utilization and conservation

Q.2: What is floral biology? Discuss in detail floral biology in Rice crop

Q.3: Important concept of breeding. Discuss in detail in cross pollinated crop

Q.4: What is centers of origin? Distributed of species and wild relatives

Section B (Attempt all questions carry 2 marks each)

Q.5: Write short comments on

1. Structure of flower
2. Define reproductive part of flower
3. Quantitative and qualitative characters
4. Floral biology of wheat
5. Vavilov

Meritorious Students

Sr.	Name	Class	Roll No.	%age / Merit
1	Gurbhej singh	B.Sc(H) Agri-III Sem-V	9523	95.6
2	Riya	B.Sc(H) Agri-III Sem-V	9535	95.3
3	Lovely	B.Sc(H) Agri-III Sem-V	9508	92.3

ADDITIONAL DUTIES

(Dr. Sarvan Kumar)
Assistant professor
Department of Agriculture

Sr.	Duties
1	In charge-ship of Agriculture, Food Processing, Fashion Technology and Lib Science at GNC Budhlada
2	Member of Research committee Guru Nanak College, Budhlada
3	Center supprendent of University Examination and home exam
4	Practical examination duties
5	Paper checking of University Exam
6	As External examiner of thesis evaluation and Via voice MSc. Plant breeding in Mata Gujri College, Fathgarh sahib

Project/Task Assigned

BSc.(Hons)Agriculture-III (Sem-V) GPB 301 Crop Improvement

Dr. Sarvan Kumar

Date of Project Assigned	Class	Project Title / Topic	Evaluation
October 2021	BSc (H) Agri-III Sem-V	Plant Ideotype Concept In Crop Improvement	A+
November2021	BSc (H) Agri-III Sem-V	Hybrid seed production technology in cereal crop(Rice crop)	A+

Teacher HOD__ Principal

Assignment

PLANT IDEOTYPE CONCEPT IN CROP IMPROVEMRNT

Subject: GPB 301- Crop Improvement

Bachelor of Science in Agriculture (Hon)

B.Sc (Hons) Agriculture

Awarded By

PUNJABI UNIVERSITY, PATIALA

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(2021)

PLANT IDEOTYPE CONCEPT IN CROP IMPROVEMRNT

Introduction

It's a biological model that's supposed to function or react in a certain way in a certain environment. C.M. Donald coined the word **"ideotype"** (1968) According to Donald, a crop ideotype is a plant modal that, when developed as a cultivar, is predicted to generate a higher amount or quality of grain, oil, or other valuable commodity.

Main Points about ideotype

A model plant or ideal plant type for a certain climate is referred to as a crop ideotype. To identify a wheat ideotype, Donald used just morphological parameters; later, physiological and biochemical variables were included to widen the idea of crop ideotype. Old varieties are predicted to yield less than ideal plants. Ideotype is a fluid concept that shifts with the seasons, type of agriculture, market demand, and so on.

Lynonyms of ideotype

Type of model plant

Plants that are ideal

Features of plant ideotype

The most effective use of natural resources will be an Ideotype. Each unit of dry matter generated will have a sufficient number of flowers/florets or other sinks to receive all photo synthates from the plant's green surface or from other portions.

Ideotype is a fluid concept.

The physical and physiological qualities of the Ideotype must result in a high harvest index. Ideotype crops must be grown as far as feasible in weed-free environments.

Type of plant ideotype (Donalds)

Market ideotype: The qualities decide whether or not the produce is marketable.

(Seed colour, seed size, preparation, and backing)

Climatic ideotype: Important characteristics for climate adaptation: (Early maturity, thermo period insensitivity, Heat and Cold tolerance, drought tolerance)

Edaphic ideotype: Salinity tolerance, mineral toxicity, and deficient tolerance traits

Stress ideotype: Resistance to biotic and abiotic stress was one of the traits studied.

Disease or pest ideotype: Resistance to the illness and pests in question is influenced by traits.

Insect ideotype: Resistance to the insects in question is based on traits.

WHAT IS IDEOTYPE BREEDING

Ideotype breeding: - Ideotype breeding, also known as plant type breeding is a method of crop improvement that involves genetic modification of individual plant characters to increase genetic yield potential.

Why we select the ideotype breeding: Individual plant characteristics are selected. Various morphological, physiological, and biochemical plant traits are used in ideotype breeding. Each trait's worth is predetermined. The phenotype of the new variety to be created is predetermined.

Differences between Traditional breeding & Ideotype breeding

Traditional breeding	Ideotype breeding
The main objective is defined before initiating the breeding work	The conceptual theoretical model is prepared before initiation of breeding work.
Selection is focused on yield and some other characters.	Selection is focused on individual plant characters
It usually includes various morphological and economic characters	It includes various morphological, physiological and biochemical plant characters.
Value of each character is not fixed in advance	Value of each trait is defined in advance.
This is a simple and rapid method of cultivar development	This is a difficult and slow method of cultivar development.
The phenotype of a new variety is not specified in advance.	Phenotype of new variety to be developed is specified in advance.

Steps involved in ideotype breeding

- ✓ Development of conceptual theoretical model.
- ✓ Selection of base material
- ✓ Incorporation of desirable characters into a single genotype
- ✓ Selection of ideal or model plant type

CHOICE OF TRAITS FOR IDEOTYPE/ SELECTION

- ❖ The importance of trait in enhancing yield.
- ❖ Heritable variation must be present for the character
- ❖ The measurement of trait should be inexpensive and reliable.
- ❖ The trait should have high heritability

WHEAT IDEOTYPE (Donald, 1968)

Characters:

- ❖ Dwarf stature
- ❖ Uniculm nature- short and strong
- ❖ Awns present
- ❖ Large ear and erect
- ❖ Few, small and erect leaves
- ❖ A short and strong stem
- ❖ High proportion of seminal roots

MAIN FEATURES OF WHEAT IDEOTYPE

Short strong stem:- It reduces the risk of lodging and would also reduce the amount of photosynthates invested in stem production.

Erect leaves: - Such leaves provide better arrangement for proper light distribution resulting in high photosynthesis or CO2 fixation.

Few small leaves: - Leaves are the important sites of photosynthesis, respiration and transpiration. Few and small leaves. Reduce water loss due to transpiration.

Larger ear: - It will produce more grains per ear.

An erect ear: - It will get light from all sides resulting in proper grain development.

Presence of awns:- Awns contribute towards Photosynthesis.

MODERN WHEAT PLANT TYPE

CIMMYT breeders are defining a spectrum of optimum wheat plant ideotypes based on greater knowledge of the physiological grounds of yield. Plants with enormous spikes and many grains per spikelet. The optimization of source-sink interactions is also being investigated in order to achieve a better balance of grain filling characteristics with cases of excessive expressiveness. The hexaploid wheat gene pool as well as other gene pools, are being investigated.

Ideotype of Rice

- Shorter culm length (100 cm)
- Greater culm diameter which increases culm strength.
- Lower relative internode elongation
- High tillering capacity
- Short, erect, thick and highly angled leaves
- High harvest index
- More penicles/ m2

NEW PLANT TYPE OF RICE (IRRI)

- Low tillering,(9-10 tillers for transplanted conditions)-all of them productive
- No unproductive tillers

Ideotype of Maize

- 200-250 grains per penicle
- Dark green, thick and erect leaves
- Vigorous and deep root system
- Low tillers
- Large cobs
- Angled leaves for good light interception
- Ideotype of Barley
- Long awns
- High harvest index
- High biomass
- Short stature

Ideotype of Cotton

- Short stature (90 – 120 cm)
- Short duration (150 -165 days)
- Responsive to high fertilizer dose
- High degree of resistance to insect, pest and diseases.

IRRIGATED CONDITION:-

- Plants of short stature (90 – 120 cm).
- Responsive to high fertilizer dose.
- High degree of resistance to insects, pests and diseases.
- High physiological efficiency.
- Short duration (150 – 165 days).

RAINFED CONDITION:-

- Short stature (75- 80cm) and compact plant habit.
- Responsive to nutrients.
- High Degree of resistance to insects and diseases.
- Medium to big boll size (3.5 – 4 gm).

Assignment

HYBRID SEED PRODUCTION TECHNOLOGY IN CEREAL CROP (PADDY / RICE)

Subject: GPB 301- Crop Improvement

Bachelor of Science in Agriculture (Hon)

B.Sc (Hons) Agriculture

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HYBRID SEED PRODUCTION TECHNOLOGY IN CEREAL CROP (PADDY / RICE)

What is hybrid rice?

- Like in other crops, the first generation progeny (F1) obtained by crossing two genetically different varieties (parents) of rice is called 'Hybrid'.
- Since rice is self-pollinated, Cytoplasmic male sterile(CMS) parent is used as female parent, which is normally called 'A' line.
- The fertility restoring line which is called 'pollinator' to the female parent is known as male parent. It is generally referred to as 'R' line, and is used for hybrid seed production.
- The hybrid combines the desirable characters from CMS line and R line. They exhibit vigour for several quantitative characters including yield.

Grain quality of hybrid:

- The rice grain quality is assessed in terms of milling, head rice recovery, size, and appearance and cooking characteristics.
- In rice, the cooking quality preferences vary from region to region.
- The adoption of hybrids depends on the profitability which in turn depends on its yield advantage over the inbred (pure line) varieties and market price of the produce as determined by cooking quality and eating characteristics.
- Quality characteristics are of paramount importance in popularization of rice hybrids

Breeding technique for commercial hybrid seed production: -

Cytoplasmic genetic malesterility system

Stages of seed production for Certification:- Breeder seed – foundation seed- seed certified

Seed Multiplication work at different Stages

- ❖ Breeder Seed stage: A (AxB), B, R lines are raisedseparately under isolation.
- ❖ Foundation Seed stage: A (AxB) and R lines raised separately under isolation.
- ❖ Certified seed stage: A and R lines are crossed underisolation to get hybrid.

Systems of hybrid seed production

- Three line method or CGMS system (popular)
- Two line method or environmental genetic male sterility (EGMS) system that involve PGMS (photosensitive genetic male sterility) and TGMS (Thermo sensitive male sterility system was developed in China and low temperature hilly areas of Tamil Nadu

Popular hybrids

CORH1 : (IR 62829A x IR 10198- 66–2R)

CORH2 : IR 58025A x C 20R

CORH3 : TNAU CMS 2A X CB 87 R (110-115 days)

ADTRH1: IR 58025A x IR 66R

Genes involved in EGMS

- One or two pairs of recessive nuclear genes (cytoplasminvolved)

Advantages of EGMS system

- Maintainer lines are not involved
- Choice of parents are more.
- No negative effect on sterile cytoplasm

Genes for fertility restoration in CGMS system: Rf1 and Rf2

COMMERCIAL SEED PRODUCTION TECHNIQUE

Land requirement : similar to variety

Isolation

Space isolation	:	Foundation seed stage : 20 m
Certified seed stage	:	100 m
Time isolation	:	20 days either earlier or later for other varieties compared with MS line.
Barrier isolation	:	• 30m of wood lot / tall crops • plastic sheets of 2m height

Season: Kharif (May- June sowing)

Favourable climatic conditions during flowering for higher seed set.

- ✓ Daily mean temperature 24 - 30^{o}C
- ✓ Relative Humidity 70 - 80 %
- ✓ The difference between day and night temperatures should be 8-10^{o}C.

- ✓ Sufficient sunshine and moderate wind velocity of 2-3 m / second.
- ✓ Free from continuous rain for above 10 days during peak flowering season.Seed set and seed yield will be affected if temperature is below 20^{o}C and above 35^{o}C during the time of flowering. In Tamil Nadu, ideal time for sowing during kharif is 2nd fortnight of May and during rabi 2nd fortnight of December.

✓ CORH 1	-.	110-115 days (May-June, Dec - Jan)
✓ CORH 2	-	120-125 days (Rabi)
✓ ADTRH 1	-	110-115 days (kharif)

Seeds

Seed selection: Purchase from authenticated source with tag and BillFor Foundation stage - (A & B lines) For Certified stage - (A & R lines)

Seed rate : Female : 20 kg /ha

Male : 10 kg /ha

Nursery Management

- ✓ Keep irrigation channels separately for the parental line
- ✓ For Dec-Jan sowing take up staggered sowing for male twice or thrice with the interval of 10-15 days (3,10,15daysfor effective seed setting)
- ✓ Keep the nursery area free of weeds.
- ✓ Apply DAP @ 2 kg / cent as basal to get vigorous seedlings.
- ✓ For April-May sowing sow the male 5 and 10 days after female line
- ✓ Even split application of fertilizer N is favourable for production ofvigorous seedlings.

Main field Transplanting Spacing

- Between A line - (15 x 15cm)
- Between A and R line - (20 x15cm)
- Between R line - (30 x 15cm)

Age of transplanting

- A line : 25 days
- R line : 14, 18, 20 days

Fertilizer

Hybrids : 150:60:60N & K applied in 3 splits

(1) During basal
(2) Active tillering
(3) Panicle initiation.

Staggered sowing of parents for synchronization

As the seed set on CMS line depends on cross pollination it is most important to synchronize the heading date of the male and female parents, especially for the hybrid combinations having parents with quite different growth duration.

In addition, in order to extend the pollen supply time, the male parent is usually seeded twice or thrice at an interval of 4-5 days.

The following 3 methods can be used to determine the differences in seedlings date for synchronization between male and female parents.

1. Growth Duration Difference (GDD) method
2. Leaf Number Difference (LND) method
3. Effective Accumulated Temperature (EAT) method

Among these 3 methods though the LND method is more reliable one, the GDD method is mostly followed since it is rather simple and easy to adopt. In GDD method by checking the previous data on the difference in duration from seedling to heading between male and female parents, the proper seeding date of both parents in current season can be determined. This method is suitable in seasons or regions where the temperature fluctuation is small.

Staggered seeding of R line for synchronization.

1. Single seeding of R line
2. Two seeding of R line
3. 3 seeding of R line.

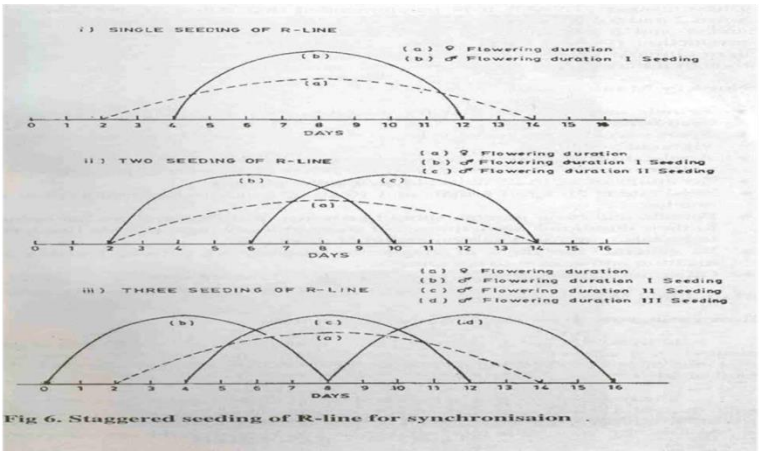

Fig 6. Staggered seeding of R-line for synchronisaion

Row ratio: 8:2 or 10:2

Factors influencing row ratio

1. Plant height of the pollinator
2. Growth and vigour of the pollinator
3. Size of the panicle and amount of residual pollen
4. Duration and angle of floret opening in CMS lines
5. Stigma exertion of CMS line.

Layout for transplanting

To facilitate out crossing, the rows of male and female in the seed production plot should be perpendicular to the prevailing wind directionexpected at flowering time of the parents. Practically a row ratio of 8:2 (A x R) is currently adopted for hybrid seed production and the transplanting sequence for 8:2 row ratio is as follows:

Transplanting of the 'R' line

Transplant the seedlings of ' R' line in paired rows of 30 cm apart. In case of 2 staggered seedlings of R line, the first and second sown R line seedlings may be planted in two separate rows at 15 cm spacing or the 1st sown seedlings may be planted in both the rows with 30 cm spacing and 2nd sown seedlings may be planted in the middle of two seedlings in both rows. Whereas in three staggered seedlings of R line all the seedlings may bepulled out separately, mixed together thoroughly by spreading one over the other and planted in the two paired rows @ 2-3 seedlings per hill with 15 cm spacing within the rows. It is more convenient, easy and labour saving method in case of large scale seed production. By proper synchronization, higher seed set and yield have been recorded in 3 staggered seedlings of R line. Leave a 145 cm or 110 cm wide block between paired rows of R line seedlings for transplanting 8 rows blocks of A line seedlings.

Row ratio, row direction, spacing and planting pattern for hybrid riceseed production.

R	R	A	A	A	A	A	A	A	A	R	R
•	•	x	x	x	x	x	x	x	x	•	•
•	•	x	x	x	x	x	x	x	x	•	•
•	•	x	x	x	x	x	x	x	x	•	•
•	•	x	x	x	x	x	x	x	x	•	•
•	•	x	x	x	x	x	x	x	x	•	•
•	•	x	x	x	x	x	x	x	x	•	•
•	•	x	x	x	x	x	x	x	x	•	•
•	•	x	x	x	x	x	x	x	x	•	•
R	R	A	A	A	A	A	A	A	A	R	R

Female: Male ratio = 8:2 wind direction : ⟷

Transplanting of the 'A' line

Transplant the ' A' line seedlings in blocks of 8 rows in between the paired rows of ' R' line seedlings. Transplant with one or two seedlings per hill with inter and intra row spacing of 15 x 15 cm in 145 cm wide block or 10 x 15 cm in 110 cm wide block according to the fertility of field. Leave a 20 cm spacing between the ' A' line rows and the nearest ' R' line rows.

Prediction of heading date

The method, which is widely used and found to be effective, is by examining the development of young panicles. Based on the morphological features, the young panicles are classified into 8 development stages. The synchronization in flowering can be predicted by using such criteria. In practice, about 30 days before heading, the male and female parents in the

seed production field are sampled and their young panicles within the main clumps and tillers are carefully observed with a magnifying lens every three days. Usually female and male parent will take 27 and 32 days respectively from panicle initiation to heading in 8 stages.

Method of observing panicle initiation

- Select the main tiller (the longest one) and cut at the basewhere stem and root join.
- Make a longitudinal slit from the base upto the top of the tiller
- Open the slit just above the nodal portion

- Observe the developing panicle with the help of a magnifyinglens.

Adjustment of flowering date

If it is found during the first 3 stages of panicle differentiation that synchronization of flowering will not be attained, the earlier developingparent should be applied with quick releasing nitrogen fertilizer (2% urea spray) or apply 35 kg /ha of urea with knapsack sprayer at 500 lit /ha and the later developing parent should be sprayed with 2% solution of DAP. By this measure a difference of 4 to 5 days may be adjusted.

If it is found during the later stages of panicle differentiation that synchronization of flowering will not be attained a difference of 3-4 days may be adjusted by drainage or irrigation because the R lines are more sensitiveto water than CMS lines. For instance, if R line is found to be earlier, drainingwater from the field will delay the panicle development. On the other hand if R line isfound to be late, higher standing waterwould facilitate rapid panicle development.If the difference in flowering period between the two parents reaches 10 days or more it is necessary to remove the panicles from early developing parent and apply nitrogen fertilizer subsequently, thus making it late emerging tillers or unproductive tillers bear panicles and subsequently achieve synchronizationof flowering.

Further during the **flowering stage** if the blooming time is found not to be synchronized (usually the R line flowers earlier than CMS line) adjustments can be made in blooming time by improving the microclimate in the field through drainage, removing dew drops from the CMS plants and spraying cold water to the R lines.

Application of Gibberellin (GA_3)

GA_3 plays an important role in rice hybrid seed production. It can adjust physiological and biochemical metabolism of rice plant especially stimulating the elongation of young cells. About 25-30%. spikelets of a panicle are inside the flag leaf sheath in most of the indica CMS lines than that of the Japonica CMS lines. GA_3 has a definite role in exertion of panicle. In general, it is recommended that 50 g /ha with knapsack sprayer in two split doses, i.e. spray on 15-20% earhead emergence and 2nd spray in the next day for enhanced seed set. GA_3 will not dissolve in water and hence it should be dissolved in 75-90% alcohol (1g in 20-25 ml of alcohol) and make the required solution. Spraying should be done at 8 to 10 a.m. and 4- 6 p.m.

Advantages of GA_3 application

- Enhances panicle and stigma exertion
- Adjust plant height of seed and pollen parents
- Speed up the growth of later tillers and increases the effective tillers
- Sets uniform panicle ear.
- Flag leaf angle is increased
- Increases 1000 grain weight
- Reduces unfilled grains
- Remarkably enhances seed setting and seed yield

Supplementary pollination

Natural out crossing was recorded less than 10% by Ram lingam et al. (1994). However, this depends upon the wind direction and its velocity.

Shaking the R line panicles by rope pulling at panicle level or rod driving during anthesis can make their anthers dehisce and spread the pollen widely and evenly thus the out crossing rate could be increased. It is more effective especially on calm or breezy days.

Generally, supplementary pollination is carried out at 30 minutes interval for 5 times daily both morning and evening during peak anthesis (10-12 am and 2-4 p.m.) until no pollen remains on the R line. It is not needed when the wind is greater than moderate breeze.

Foliar spray

Foliar spray of 2% DAP increases yield and qualities of seed

✓ Short duration:	Ist Spray	on 60 DAS
	II nd "	80 "
✓ Medium duration:	Ist Spray	on 80 DAS
	II nd "	100 "

Roguing

Remove the undesirable plants either in A or R line rows that differ from plants that are true to type. The pollen shedders and off types are removed.

The undesirable plants come from many sources. They may be volunteer plants from the previous cropping.

The most important stages for rouging are at maximum tillering, at flowering and just before harvesting.

Rouging in hybrids

In A line remove pollen shedders. In A line only 40-50% of seed set is possible. If > 60-70% seed is noticed and the panicle is drooping it would be R line (or) other varieties.

Plants to be removed	A line	B line	R line
Diseased plants	All	All	All
Parental lines	R line & B line	A line & B line	R line & A line
Early flowering plant	All	All	All

Rogues / off types : Based on variation in phenotypic Characters

Harvesting, threshing & drying

- ✓ Turning of 90% green seeds to straw yellow colour is the stage ofphysiological maturity
- ✓ Moisture content will be 17-20%.
- ✓ Male parent should be harvested first .
- ✓ Care should be taken to avoid admixture of male line with female linewhile harvesting.
- ✓ The female parent should be threshed at 16-17% moisture contentseparately in a well cleaned threshing floor.
- ✓ The threshed seed should be winnowed and dried to reduce the seedmoisture content to 12%
- ✓ The seed should not be dried under direct sun between 12 to 3.00 p.m. during hot sunny days.

Seed treatment

Seeds are treated with thiram / captan @ 4 g/kg. or with 5 gmhalogen mixture. The halogen mixture is prepared by mixing $CaOCl_2$ + $CaCO_3$ for 1 week in air tight container.

Storage

- ✓ Fort short term storage use gunny bag or cloth bag.
- ✓ For long term storage use polythene bag of > 700 gauge and dry theseeds to 8% moisture content.
- ✓ When compared with varieties, the hybrids and parental lines A & Blines are poor in storability.
- ✓ The order of the storage potential is R > F1 > B > A.

Others - As in variety

Seed yield: Hybrid yield (F1) : 800-1200 kg ha-1

General Tips

- ✓ Nursery period, spacing, seed rate, fertilizer dose and days to maturationvary with short, medium and long duration varieties.
- ✓ Grain of paddy could be (visual) graded as long slender, short, medium bold based on shape but could not be separated on mechanical grading minding.
- ✓ Textures variation though not permanent exists in paddy seeds.
- ✓ Seeds of paddy have carbohydrate as the main storage reserve in theform of amylase and amylopectin which differentiates the japonica and indica varieties.
- ✓ SPLIT HUSK**:** Problem of split husk occur in hybrid rice seed production where the lemma and palia are not closed properly at tip portion. Occurrence is claimed to nutrient deficiency synchronization defects and genetic factors, as it
- ✓ Occurs more in female line than male line. Split husk reduces the germination due to heavier load of fungal colonies. Seed multiplication ratio 1:152
- ✓ Seed renewal period : three times