Reasons for Mendel's Success

1. Method of working →

1. Hybridization of Pure form using Emasculation and bagging.
2. He maintained statistical record of all the experiments and analysed them

2. Selection of material →

Mendel selected garden pea as his experimental material because it has following features :-

a) It was an annual plant

b) Short life cycle - because of which it was possible to study several generations within short period of time

c) Bisexual flower.

d) Easily to Handle due to its large size

e) Self pollinating.

f) It is easy to get pure lines for several generations

g) Easy to cross by emasculation and Bagging.

h) Seven pairs of characters were present on four different pairs of chromosomes.

3. Selection of trait →

Mendel selected 7 pairs of contrasting character related as dominant and recessive.

Seven pairs of contrasting character in pea plant

character	Dominant	Recessive
1. Stem length	Tall	Dwarf
2. Flower colour	violet	white
3. Flower Position	Axial	Terminal
4. Pod shape	Inflated	constricted
5. Pod colour	Green	yellow
6. Seed shape	Round	wrinkled
7. Seed colour	Yellow	Green

Methods of Analysis

Punnet square — Given by Reginald C Punnet. Checker board method to calculate Probability of all possible genotypes of offspring in a genetic cross.

T T t t

(T) (T) (t) (t)

F1 Generation — Tt [Hybrid]

Selfing of F1 — Tt × Tt

♂ / ♀	T	t
T	TT	Tt
t	Tt	tt

F1 generation

Phenotypic ratio — 3 Tall : 1 Dwarf

Genotypic ratio — TT (Pure tall) : Tt (Hybrid : Tall) : tt (Dwarf) : 1 : 2 : 1

(2) Reciprocal cross —

Two crosses concerning the same character but with reversed Sexes.

e.g I] ♂ TT × ♀ tt

(T) (T) (t) (t)

F1 → Tt × Tt

II] ♀ TT × ♂ tt

(T) (T) (t) (t)

F1 → Tt × Tt

F1 generation

♂ / ♀	T	t
T	TT	Tt
t	Tt	tt

3 Tall : 1 Dwarf

1 : 2 : 1

F1 generation

All Tall

1 : Tall : 2 Hybrid : 1 Dwarf

Back cross

It is cross performed Between hybrid and one of its parent [i.e Dominant or Recessive]

→ Back cross is of two types

Test cross — out cross.

1. Test cross — when a cross is made between unknown individual to its recessive parent to know its genotype, is called Test cross.

It is to Test the genotype of individual

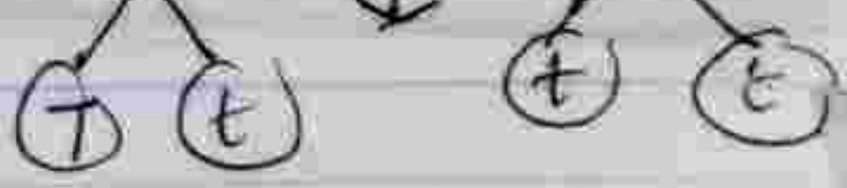
e.g If plant is Tall then two possibilities are a) T T (Pure tall) b) Tt (Hybrid tall)

a) T T x t t
Individual (recessive parent)

♀ \ ♂	T	T
t	Tt	Tt
t	Tt	Tt

all Tall

Tt x t t



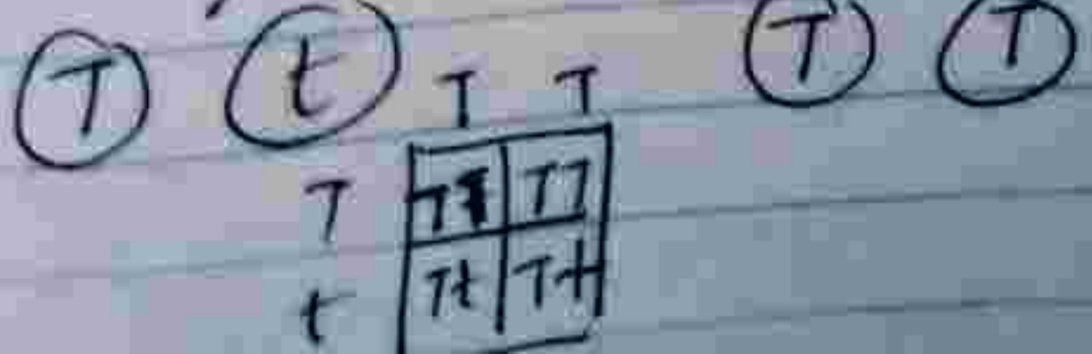
	T	t
t	Tt	tt
t	Tt	tt

1 : 1

50% Tall : 50% dwarf

(2) Out cross → Crossing of hybrid with dominant Parent e.g

Tt x T T
(Individual) (Dominant Parent)



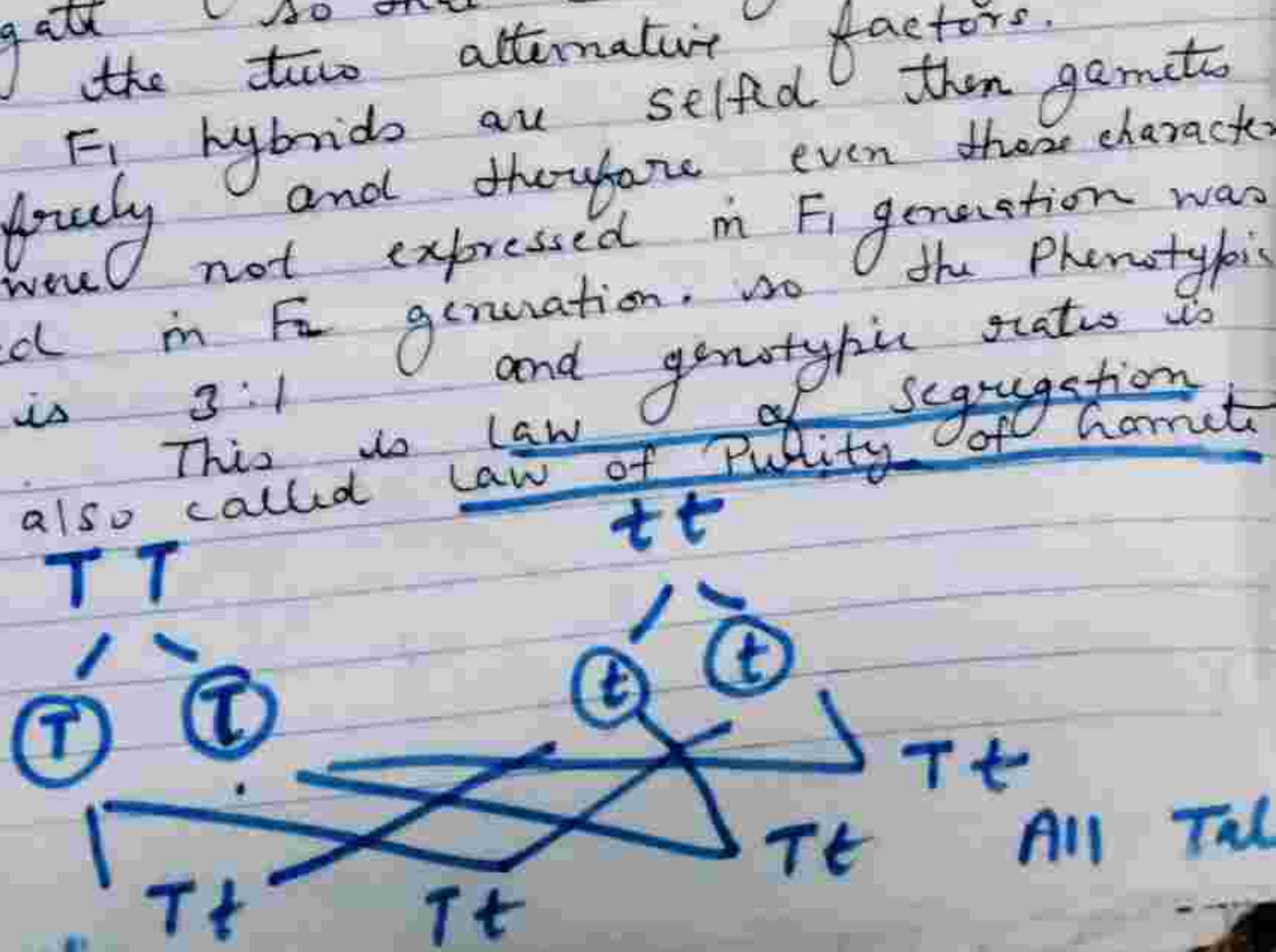
♀ \ ♂	T	T
T	TT	TT
t	Tt	Tt

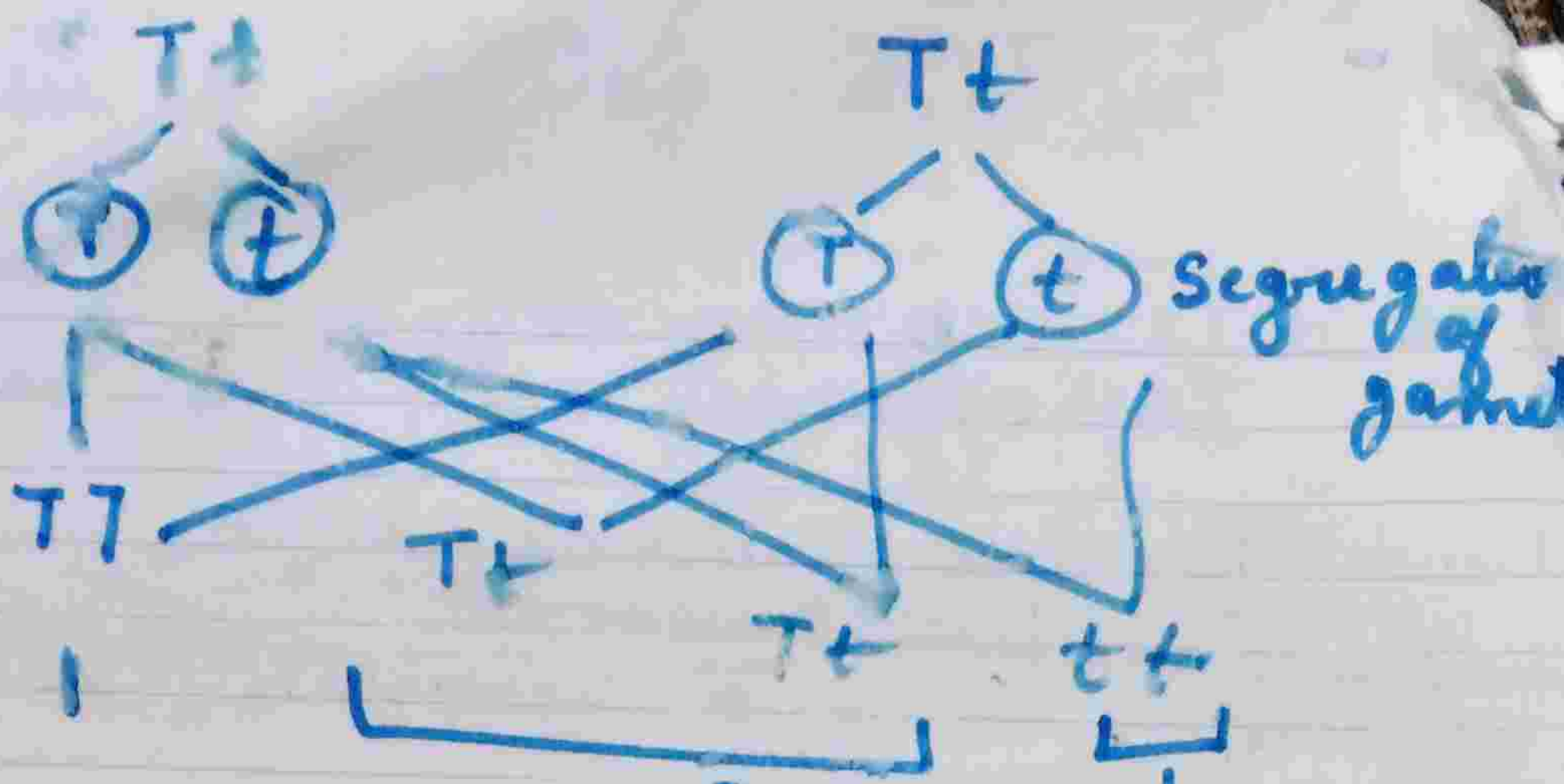
Mendel's experiment and Laws of Inheritance

* Mendel has done experiment on Pea plant
→ Mendel's First Law i.e Law of Dominance and II Law i.e Law of segregation is based on Monohybrid cross.
→ Mendel's III law is based on Dihybrid cross

→ Mendel crossed (Self pollinated) Pure tall and dwarf plants. In F1 generation all plants were tall. It is I law i.e It occurs due to dominance
→ Mendel explain that when tall is crossed with Dwarf then in F1 generation all are tall because only dominant character is expressed in F1 generation Thus is law of dominance.
→ In an individual the factors occur in pairs. one from either parent.

→ During gamete formation the unit factors segregate so that each gamete gets only one of the two alternative factors.
→ When F1 hybrids are selfed then gametes fuse freely and therefore even those characters which were not expressed in F1 generation was expressed in F2 generation. so the Phenotypic ratio is 3:1 and genotypic ratio is 1:2:1. This is law of segregation It is also called law of Purity of gamete





Phenotypic ration 3 : 1 Tall :

Genotypic ration 1 : 2 : 1 Dwarf

Pure Tall hybrid tall

Dihybrid Cross

Cross between two pairs of contrasting traits This experement was done by Mendel to study segregation and transmiss of two pairs of contrasting traits at a time.

→ Cross is made between Round yellow a wrinkled green seeds.

→ In F_1 all were tall [Law of dominan

→ In F_2 gamete segregation [Law of Segrg

→ As factor for different characters are not dependent on each each other i.e assort indepen -ently.

RRYY
Yellow round

rryy
wrinkled

↓

RrYy

RY Ry rY ry

Round yellow — 99
Round green — 1
Round wrinkled yellow — 1

Forkline method for gamete formation

A
Factors for seed colour

B
Factors for seed shape

C
Genotype of Gamete

R → Y → RY
R → y → Ry
r → Y → rY
r → y → ry

Type
No of ~~No~~ of gamete — 2^n
n - no of hybrid
e.g n - 2 in RrYy
$2^2 = 4$
n - 3 in AaBbCc
$2^3 = 8$

No of F_2 Phenotype — 2^n
No of F_2 Genotype — 3^n