

RED GRAM (*Cajanus cajan*) (2n = 22)

Pigeon pea / Red gram is an important pulse crop next to chickpea in India. India is a largest producer i.e. 90% of the world's production

Origin: Africa and India

Distribution: India, Uganda, Kenya, West Indies, Burma etc. In India, Maharashtra, Uttar Pradesh, Madhya Pradesh, Karnataka, Gujarat and Andhra Pradesh and under irrigated belt in Punjab, Haryana and Rajasthan.

Progenitor: *Cajanus cajanifolius*

Atylosia lineate

Genus *Cajanus* and *Atylosia* and have many similarities. *Cajanus* has more than 30 species. The view is that *Cajanus* arose from *Atylosia*. In western ghats, West Bengal and Orissa, *Atylosia* species are known as wildtur. Now this genes has been included in *Cajanus*.

Breeding objectives:

1. Evolution of long duration high yielding variety suitable for rainfed to replace the local land races :

SA1 - Released during 1940

2. To evolve short duration (105 days) varieties suitable for irrigated / mixed crop with ground nut.

ICPL 87 - ICRISAT

3. Breeding for bold grain type with desirable seed coat color

HY 3C long duration variety with dull white seed coat and bold grains.

4. Breeding for vegetable type

Green pods with bold seeds are used as substitute for green peas in some areas are perennial types

5. Breeding for resistance to pests.

Heliothis is the major pest, terminal cluster types are highly susceptible. All our varieties are highly susceptible.

6. Breeding for disease resistance :

Sterility mosaic, root rot, blight are important diseases. Wild species *Cajanus scaraboides*, *C. lineata* are having resistance.

7. Breeding for high protein content and quality

Mean protein content 23%. The wild species have 27% to 29% , Red seed coat contains more polyphenol (Tannin) than white seed coat. So preference is towards white seed coat. Red grain contains lesser amount of sulphur containing amino acid. When we increase protein content there will be lesser amount of these amino acids. So care is to be taken to increase them.

8. Breeding high yielding perennial redgram suitable for bund cropping

Breeding procedures

1. Introduction :

E.g. Prabhat short duration variety from IARI, ICPL 87 from ICRISAT.

2. Pure line selection

Earlier breeding work was based on the assumption that Redgram is a self pollinated crop. However it was later found to be often cross pollinated crop.

3. Hybridization and selection :

Inter varietal : VBN 1 (Prabath x NY 34) (T.12 x 102)

Inter generic : *C. cajanus* x *Cajanus lineata*

C. cajanus x *C. scaraboides* are being attempted

4. Mass selection :

5. Population improvement :

Using male sterile line and recurrent selection methods.

Two populations are used, one is seed parent and the other is pollen parent. The seed parent must have one or two easily identifiable recessive character and the pollen parent more dominant genes. The seed and pollen parents are sown in alternate rows so as to maximize natural cross pollination.

The F_1 's and selfed ones are identified in S_0 generation. The identified F_1 s are space planted in the next generation S_1 . In S_2 generation they are yield tested in 3 environments and best ones are either recycled or taken to conventional breeding programme.

6. Mutation breeding

LRG-30 variety was susceptible to wilt was irradiated and wilt resistant variety was developed as ICPL-270

7. Heterosis breeding

Red gram Ideal plant type

a) Long duration:

The genotype that have steady rate of growth and have a moderate harvest index.
High seed weight
Long pods
Increased number of pod bearing branches.

b) Short duration :

Dwarf in nature with erect branches having high dry matter production
High seed wt.
Long pods.
Increased no of seeds / Pod
Less flower dr op.

c) Breeding centers:

Internation Crop Research Institute for Semi Arid Tropics (ICRISAT) Hyderabad

Practical Achievement:

Varieties: Prabhat, Vishakha, Sharada, ICPL – 87

Hybrids: ICPH – 8

SOYBEAN (*Glycine max*) $2n = 40$

One of the important oil yielding crop of world it is miracle crop giving 42 – 45 per cent protein and 19-20 per cent oil it belongs to family leguminosae

Origin: China

Distribution: USA, Brazil, China, Argentina and India.

Progenitors: *G. usuriensis*

G. tomentolla

G. tabacina

G gracilis

Glycine max is originated from *G. usuriensis* and *G. tomentolla*

Breeding objectives:

1. Breeding for short duration high yielding varieties

The yield of soy bean plant is determined by size, number of seeds per pod and number of pods / plant. The number of pods/ plant is determined by number of nodes / plant, number of pods / node. Each of the above components of yield are polygenic in inheritance and so it is complex.

The duration is also determined by multiple genes. Maturity is correlated with height of the plant. Early varieties will be short is stature.

2. Breeding varieties suitable for rice fallows

Short plants 65 - 70 days duration. Suitable for inter cropping also in banana and sugarcane.

3. Breeding for quality

a) Seed coat color and quality – Yellow, Black, Brown Green

b) Oil content and quality

c) Protein content

a) Seed coat color:

May be yellow, green, black, brown or combination of all the above colours. For oil extraction yellow color is preferred because of high oil content where as black seeded varieties are low in oil content but high is protein content.

b) Oil content and quality:

Oil content is greatly determined by environment :

Yellow seed coat varieties are rich in oil. Complex character determined by poly genes.

c) Protein content and quality:

Ranges from 35 to 50%, protein content is negatively correlated with oil content so while breeding for high protein content a compromise is to be made.

4. Breeding for vegetable type

AVRDC, Taiwan has evolved vegetable types

5. Breeding for forage type of soybean

6. Breeding for non -shattering type

E.g. Lee, Co2

7. Breeding for YMV resistant lines

Co 2

Breeding Methods:

1. Introduction :

EC 39821 from Taiwan - released as Co1

2. Pure line selection

Co1

3. Hybridization and selection

Clark,

4. Mutation breeding.

B reeding centers:

- Asian Vegetable Research and Development Centre (AVRDC) Taiwan
- International Institute of Tropical Agriculture (IITA) Nigeria
- In India National Research Centre for Soybean (NRCS) Indore (M.P)

Practical Achievements:

Varieties: Bragg, Clark 63, Hardee, MACS 13 etc.

Lecture No: 9

GREEN GRAM (*Vigna radiata*) $2n = 22$

Also known as mung bean

Origin: India

Distribution : India, Pakistan, Bangladesh, Srilanka, Philippines, Taiwan, Thailand, Nepal and Southern Asian countries. In India, Maharashtra, UP, MP, Karnataka, Gujarat A.P, Tamil Nadu and Rajasthan.

Progenitor: *Vigna radiata* var: *sublobata*

Breeding objective:

1. High yield, medium duration dry land varieties

2. High yielding, short duration irrigated varieties :

Lines having rapid growth rate or dry matter increase associated with high harvest index.

3. Breeding for rice fallows

4. Breeding for disease resistance , YMV, Leaf crinkle virus , Tarai local Lm 214 - resistant

5. Breeding for quality

- a) Mung bean has highest digestibility among grain legumes from 83 to 90%. Varieties having bold seeds to use as sprouts is the aim.
- b) Transfer of high methionine content from black gram to green gram.
- c) High dal recovery - 80% and more
- d) Less hard seed.

Breeding Methods:

1. Introduction - Pusa baisaki

2. Pure line selection - Co1

3. Hybridisation and selection

Inter Varietal :

Inter specific - To transfer high methionine content from black gram to green gram.

I. radiata x *V.umbellata* rice bean to transfer resistance to bean fly crossing with *V.radiata* var. *sublobata* resistance to bruchids

5. Mutation breeding

Co4 - mutant of Co1

6. Embryo culture :

Green gram x Black gram

Ideal plant type

- 1. 60 - 65 days duration with determinate habit for irrigated conditions
- 2. 80 days duration with indeterminate type for dry land condition
Plants with more pods and seeds, increased branches podding from base of main stem with synchronised maturity non - shattering habit.

Varieties:

Jawahar – 45, WGG-2, LGG- 127

Black gram (*Vigna mungo*) $2n = 22$

Origin: India

Distribution: India, Pakistan, Srilanka, and South Asian countries. In India, Maharashtra, UP, MP, Karnataka, Gujarat A.P, Tamil Nadu and Rajasthan.

Progenitor: *Vigna mungo* var *silvestris*

Vigna radiata var *sublobata* – common progenitor of green gram and black gram.

Breeding objectives

1. Evolving medium duration high yielding varieties for dry land cultivation.
2. Evolving short duration high yielding varieties suitable for irrigated conditions.

This can be used as mixed crop in cotton, turmeric Short duration varieties are Co2, Vamban 1, 2 and 3.

3. Evolving short duration varieties suitable for rice fallow conditions

4. Breeding varieties resistant to diseases

YMV is a serious disease. Leaf crinkle virus, powdery mildew.

5. Pest : White fly vector for YMV and leaf crinkle, leaf eating caterpillar

6. Breeding for better quality

24% protein. There are lines having 27% protein. These can be utilized.

Quality of black gram is determined by

- a) Protein content
- b) Methionine content 1.17%
- c) cooking quality - Time
- d) % of hard seeds.
- e) Dal recovery 70%

Breeding methods

1. Introduction :
2. Pure line selection :
3. Hybridization and selection
 - a) Intervarital
 - b) Inter specific :

Vigna mungo x *V.mungo* var.*silvestris* - Pantnagar. YMV resistant lines obtained. but pod shatters. More number of back crosses suggested.

Vigna mungo x *V.radiata* for increasing pod length, digestibility. Sterility is the main problem. Few plants obtained revert back to parental form.

- 4) Mutation breeding

- 5) Embryo rescue - Attempted in inter specific crosses.

Ideal plant type

For irrigated and Rice fallows

Determinate type, short duration, high dry matter producing with 30cm plant ht. Photo insensitive.

For rainfed condition .

Semi determinate with pod setting from base of the main stem; higher pod length and more number of seeds / pod.

B reeding centers:

ICRISAT, - Hyderabad

ICARDA, - (International Crops for Agricultural Research in

Dryland Areas) – Syria AVRDC - (Asian Vegetable Research and Development Centre)

IIPR - (Indian Institute of Pulse Research), Kanpur

Varieties:

Black gram : T9, T27, LBG-17, LBG-402