



RVSKVV, Gwalior

K.N.K. College of Horticulture, Mandasaur (M.P.)

Class : B.Sc. (Hons.) Horticulture III Yr I Sem.

Course Title : Introduction to Major Field Crops (AGR 313)

Credit : 2(1+1)

Topic: Cultivation of Greengram

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General Information

Botanical Name: *Vigna radiata*/ *Phaseolus aureus*

Family: Fabaceae/Leguminoceae

Origin: India

- ➡ Third important crop of pulses next to Chickpea and pigeonpea
- ➡ Versatile for grain, forage and green manure, as mixed or sole crop or catch crop
- ➡ Fixation of Atm. N: 38-40 kg/ha



Nutritional Importance: Protein-25%, Carbohydrate-55-60%, fat-1.3%, Ascorbic acid (Vitamin C) is synthesized in sprouted seeds.

Soil:

Loam to sandy loam soil with pH of 6.5-7.0 is best but it can be grown in variety of soil types with proper water management.



Climate:

- ➡ Hot and humid climate.
- ➡ 25-30⁰C temperature is essential for growth and development.
- ➡ 75-90 cm annual rainfall.

Land Preparation:

- ➡ Summer ploughing once in 3 years
- ➡ One harrowing before onset of monsoon
- ➡ One harrowing after receipt of 50-75 mm rainfall
- ➡ Sowing and seed covering



Sowing Management

1. Sowing Time: Last week of June to first week of July (*Kharif*)
Upto 15 March (*Zaid*)

2. Seed Treatment:

- (a) Carbendazim @ 2 g + Thiram @ 1 g or Thiram @ 3 g/kg seed
- (b) Trichoderma chilonis @ 4 g/kg seed
- (c) Rhizobium + PSB @ 8-10 g each/kg seed



Sowing Management

3. **Seed Rate :** 12-15 Kg/ha (*Kharif*)
25-30 kg/ha (*Zaid*)
4. **Spacing:** 30-45 cm x 10 cm for *Kharif*
20 cm x 10 cm for *Zaid*
5. **Sowing Depth:** 4-6 cm
6. **Sowing Method:** Line sowing through seed drill



Nutrient Management

Nutrients	N	P	K	S	Zn
Doses (Kg/ha)	20	60	20	20	20



Water Management

Irrigation

Pre-flowering stage

Pod development stage



Weed Management



Triantema monogyna
(santhi)



Amaranthus viridis
(choulai)



Cyprus rotundus
(motha)



Celosia argentic
(safed murg)



Phyllanthus niruri
(hazar dana)



Sorghum helepense
(Barru)



- Initial 25 days after sowing (DAS) is critical period of crop-weed competition. During this period, crop should be kept with minimum competition from weeds.
- Due to continuous rains in *Kharif*, mungbean suffers from intense weed competition. The crop requires 2 weedings, first at 20-25 DAS and the later at 40-45 DAS. In summer, one weeding is sufficient. However, whenever labour is in short supply or the rainfall pattern does not allow early hand-weeding, herbicides need to be used.



Name of Weedicide	Dose (g. a.i./ha)	Water (liter)	Time of Application	Controlled Weeds
Pendimethalin	1000 g.	500	0-3 DAS	Grasses & some broad leaved weeds
Imazethapyr	100 g.		15-20 DAS	Grasses, sedges & broad leaved weeds
Quizalofop-ethyl	40-50 g.		15-20 DAS	Grasses



Varieties

Varieties	Maturity days	Average yield (q/ha)	Remarks
TJM -3	60-70	10-12	Yellow Mosaic (YM) and Powdery Mildew (PM) resistant, for <u>Kharif</u> and <u>summer</u> cultivation
JM-721	70-75	12-14	Yellow Mosaic (YM) and Powdery Mildew (PM) tolerant, for <u>Kharif</u> and <u>summer</u> cultivation
HUM-1	65-70	8-9	YM and leaf spot tolerant, for <u>Kharif</u> and <u>summer</u> cultivation
PDM-11	65-75	10-12	YM resistant, for <u>Kharif</u> and <u>summer</u> cultivation
Pusa Vishal	60-65	12-14	for <u>Kharif</u> and <u>summer</u> cultivation



Pest and Disease Management

Insects:



Aphids



Jassid



Thrips



White Fly



Gram Pod Borer



(1)Aphid, Jassids, Thrips, White Fly and Pod borer :

- **Grow YM resistant varieties**
- **Spray of Dimethoate 30 EC, 1 liter**
- **For pod borer, spray of Indoxacarb 14.5 SC, Quinalphos 25 EC, 1.50 litre or Cypermethrin 10 EC 750 ml/ha with 800-1000 liter water.**



Diseases:

(1) Powdery Mildew:

- Grow resistant varieties.
- Timely sowing.
- Spray of Penconazole @ 5 ml or Karathane or Sulphur dust 2.5 g/litre of water. Repeat spray after 15 days of first application.



(2) Root Rot:

- Use of disease free seed material.
- Seed treatment with Thiram 3 g + Trichoderma @ 4 g/kg seed
- Removal and burning of disease affected plants.





(3) Yellow Mosaic:

- **Grow resistant varieties**
- **Removal and burning of disease affected plants.**
- **Spray of Thiamethoxam 25 WG, 2 g./liter or triazophos 40 EC, 2 ml/liter**





Harvesting Management

- ▶ When pods are turned into brown colour, two to three pickings are done.
- ▶ Pickings should be carried out only during morning hours.
- ▶ Seeds stored at 8-10% moisture.

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Topic: Alley Cropping/Hedgerow cropping/ Hedgerow intercropping

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Alley Cropping/Hedgerow cropping/Hedgerow intercropping:

- Developed at IITA (International Institute for Tropical Agriculture), Nigeria in 1970s.

Definition: Alley cropping is a farming system in which arable crops (food crops) are grown in alleys formed by fast growing N fixing trees established mainly to hasten soil fertility restoration and enhance soil productivity.



Advantages:

1. It provides higher total biomass per unit area than arable crops alone.
2. It provides green fodder for animals.
3. It provides foliage which used as green manure or mulch in the fields.
4. It provides additional employment opportunities during the off season.
5. It protects the soil from erosion in the hilly areas.



Objectives of Alley- cropping:

The main objective of alley cropping is to get green and palatable fodder from hedge rows in the dry season and produce reasonable quantum of grain and stover in the alleys during the rainy /cropping season.

Trees used in alley-cropping:

N fixing trees used in alley cropping: *Acacia nilotica*, *Albizia lebbek*, *Cassia siamea*, *Casuarina equisetifolia*, *Dalbergia sissoo*, *Gliricidia sepium*, *Leucaena leucocephala*, *Sesbania sesban* etc.



Walnut and maize alley cropping practice

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Topic: Crop Rotation

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Crop Rotation

Crop rotation is the agronomic practice of growing crops on the same paddock in sequence.

or

The crop rotation is stated as growing one crop after another on the same piece of land on different timings (seasons) without impairing the soil fertility.



Principles of crop rotation

The basic principles of crop rotations are as follows:

- Deep rooted crops should be succeeded by shallow rooted crops such as cotton, castor, pigeon pea-potato, lentil, green gram etc.
- Dicot crops should be rotated by monocot crops such as mustard, potato-rice, wheat- sugarcane.
- Leguminous crops should be succeeded by non-leguminous crops and vice versa (green gram- wheat).
- Exhaustive crops should be succeeded with restorative crops such as potato, sorghum, sugarcane, castor- sunhemp, black gram, cowpea.
- Grain crops should be followed by foliage crops such as, wheat-dhaincha, black gram.



- Long duration crops should be succeeded by short duration crops such as sugarcane, napier, Lucerne- cowpea, black gram, ground nut.
- Crops susceptible to soil borne pathogens and parasitic weeds should be followed by tolerant trap crops such as sugarcane-marigold, mustard (for nematodes); tobacco- rice, pulses (for orobanche); pearl millet-castor (for striga); lucern, berseem- oats (for cuscuta).
- Crops with problematic weeds should be followed by clean crops/multi cut crops and other dissimilar crops such as wheat- puddle rice for *Phalaris minor*; berseem- potato for *Chicorium intybus*; rice- vegetables for *Echinochloa crusgalli*.
- Heavy irrigation and intensive labour requiring crops should be followed by less water and labour requiring crops such as sugarcane, paddy- mungbean and sesame.



Characteristics of good rotation

1. It should be adoptable to the existing soil climate and economical factor.
2. It should be based on proper land utilization.
3. It should contain a sufficient number of soil improving crops to maintain and build up organic matter content of the soil.
4. It should provide sufficient fodder for live stock reared on farm.
5. It should be so arranged so as to make economy in production and labour utilization.
6. It should be so arranged as to help in control of weeds, plant diseases and pests.
7. It should provide maximum area under most profitable cash crop adopted in the area.



Advantage

- Crops grown in rotation reduce **greenhouse gas emissions** because of the lower amount of N fertilizer added. For example, if cereal crops follow a leguminous crop, the rotation can fix atmospheric N through rhizobacteria.
- Crop rotation maintains and improves soil fertility.
- Prevent – build up of pests, weeds & soil diseases.
- Control of soil erosion.
- Better utilization of nutrients and soil moisture.
- Provide proper labour, power and capital distribution throughout the year.
- Slow but steady income, which is beneficial to marginal and small farmers.
- Higher chances to provide diversified commodities.
- Deep rooted crops work the soil below plough layer.

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Blackgram/Urid

B.N: *Vigna mungo* L./ *Phaseolus mungo* L.

Family: Fabaceae/Leguminosae

Origin: India

Nutritional Importance: Protein: 25%, Ascorbic acid (Vitamin C) is synthesized in sprouted seeds.

Area and Distribution:

World: India, Sri Lanka, China, Myanmar, Pakistan, Fiji, Africa and America

India: Rajasthan and Maharashtra





Classification

According to Bose (1932) *Vigna mungo* is subdivided into two subspecies.

(1) *Vigna mungo* var. *niger*: It includes varieties which mature early and have bold seeds of black colour.

(2) *Vigna mungo* var. *viridis*: It includes varieties having longer maturity period. Seeds are of small size and green colour.

Climate: Hot and humid climate.

25-30°C temperature is essential for growth and development.

75-90 cm annual rainfall.

Grown successfully from sea level up to an elevation of 1800 meters. Heavy rains and cloudy weather at germination and flowering stage are harmful.



Soil: loams or slightly heavy clay loam soils with pH of 6.5-7.0 is best but it can be grown in variety of soil types with proper water management.

Land preparation and tillage: (Same as greengram)

- (a) Summer ploughing once in 3 years
- (b) One harrowing before onset of monsoon
- (c) One harrowing after receipt of 50-75 mm rainfall
- (d) Sowing and seed covering



Seed Treatment: (same as greengram)

- (a) Carbendazim @ 2 g or thiram @ 3 g/kg seed
- (b) Trichoderma chilonis @ 4 g/kg seed
- (c) Rhizobium + PSB @ 25 g each/kg seed

Seed Rate : 12-15 Kg/ha for Kharif and just double seed rate for other seasons. For *utera* cropping, the highest seed rates (30-50 kg/ha) are used.

Spacing: 30 cm x 10 cm

Sowing depth: 4 cm

Sowing method: Line sowing through seed drill. In *utera* cropping seed is broadcast in standing rice crop.



Nutrient Management

- In case of light soils of poor fertility, it needs addition of organic manures like FYM or compost @ 8-10 tonnes/ha.
- If organic manure is not available, fertilizer application is necessary.
- 20 kg N/ha. 40-60 kg P₂O₅/ha, 20 Kg K/ha, 20 Kg elemental S/ha as basal at the last ploughing. Application of 20 kg/ha each of zinc sulphate is essential for higher yields.



Water management: (Same as greengram)

- *Kharif crop* is predominantly grown as a rainfed crop, and usually receives no irrigation. Under prolonged dry spells, the crop requires one to two irrigation at flowering and pod formation stages.
- During summer seasons, the crop is grown under irrigated conditions. Pre-sowing irrigation is a must to ensure adequate soil moisture for germination. Besides a pre-sowing irrigation, 3 irrigations at critical stage required, the first at pre-flowering stage (20-25 days), the second at flowering (25-40 days) and the third at grain-filling stage, are necessary.
- In summer season (grown after wheat) the irrigation must be applied at 10-15 days interval depending upon situation. No irrigation should be given after 40-45 days of sowing.
- **In situ/Ex situ moisture conservation:** 1 hoeing at 15 to 20 days after sowing.



Weed management :(Same as greengram)

➤ **Major weeds of blackgram** are *Triantema monogyna* (Santhi), *Cyprus rotundus*

(nut grass/ motha), *Amaranthus viridi* (Cholai), *Phylanthus niruri* (Hazar dana), *Celosia argentia* (Chilmil) and *Sorghum helepense* (Baru).

➤ Initial 30-40 days after sowing is critical period of crop-weed competition. During this period, crop should be kept with minimum competition from weeds.

Due to continuous rains in *kharif mungbean* suffers from intense weed competition. The crop requires 2 hand weeding, first at 20-25 DAS and the later at 40-45 DAS. In summer, one weeding is sufficient. However, whenever labour is in short supply or the rainfall pattern does not allow early hand-weeding, herbicides need to be used.



➤ Pre-plant incorporation of Fluchloralin @ 1 kg ai/ha. Preemergence application of Pendimethalin @ 1-1.5 kg a.i. /ha in 500 litres of water ensures weed control. The herbicide should be applied just after sowing. If the soil moisture is not sufficient in the top soil then herbicide should not be applied.



Varieties:

Varieties	Maturity days	Average yield (q/ha)	Remarks
T-9	70-75	10-11	-
Khargone 3	85-90	08-10	Spreading type
PDU-1 (Basant bahar)	70-80	12-14	Recommended for summer
JU-2	70-75	10-11	-
Pant U-30	70-75	10-12	YM resistant



Pest and Disease Management: Same as greengram)

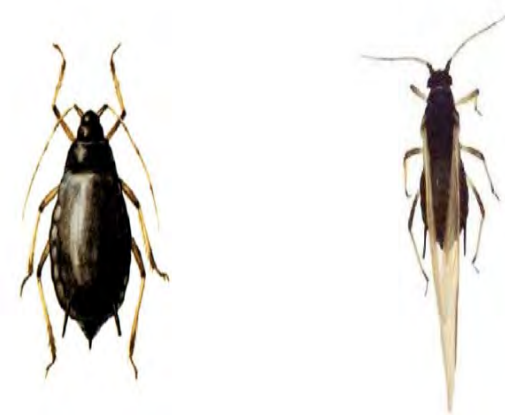
Insects:

(1) Bean Aphid:

Symptoms of damage-

- Both nymphs and adults cause the damage by sucking the plant sap.
- Infested pods become deformed, withered and malformed.
- Honey dew secretion with black ant movements
- Severe infestation may result in complete drying of affected pods

Control: Emamectin benzoate 5%SG 220 g/ha or Indoxacarb 15.8%SC 333 ml/ha in 500 liter of water. The insecticidal treatment has to be repeated as soon as aphid population is found to have built up again.





(2) Thrips:

Symptoms of damage-

- The leaves are mottled with characteristic silverying due to the attack of insect especially under dry spell. Later leaves dry and shed.
- Damaged plants do not develop pods

Control: Spray carbaryl 50WP 1.0 kg in 700 L water.





(3) White fly:

Symptoms of damage-

- Both nymphs and adults suck plant sap and lower its vitality. Severe infestation results in premature defoliation, development of sooty mould or honey dew and shedding of flowers and pods.
- Vector of yellow mosaic virus.

Control: Spray dimethoate 30 EC 750 ml in 700 - 1000 L /ha.





Diseases:

(1) Powdery Mildew:

Symptoms:

- Small, irregular powdery spots appear on the upper surface of the leaves, sometimes on both the surfaces.
- The white powdery spots completely cover the leaves, petioles, stem and even the pods.
- The disease becomes severe during flowering and pod development stage.

Control:

Spray of Penconazole @ 5 ml or Dinocap @ 10 ml or Tridemorph @ 5 ml or water soluble sulphur 30 g in 10 litres of water. Repeat spray after 15 days of first application.





(2) Dry Root Rot:

Symptoms:

- The disease symptom starts initially with yellowing and drooping of the leaves. The leaves later fall off and the plant dies within a week. Dark brown lesions are seen on the stem at ground level and bark shows shredding symptom. The affected plants can be easily pulled out

Control:

Use of disease free seed material. Seed treatment with Thiram 3 g + Trichoderma @ 4 g/kg seed, removal and burning of disease affected plants.





(3) Anthracnose:

Symptoms:

- The symptom can be observed in all aerial parts of the plants and at any stage of crop growth.
 - Symptoms are circular, black, sunken spots with dark center and bright red orange margins on leaves and pods
 - In severe infections, the affected parts wither off.
- Seedlings get blighted due to infection soon after seed germination.

Control:

- Remove and destroy infected plant debris in soil.
- Treat the seeds with carbendazim at 2g/kg seed.
- Spray carbendazim 500 g or mancozeb 2 kg/ha after the appearance of disease and repeat after 5 days.





Extra Information about Blackgram

- Protein-25%
- Green manuring crop.
- Richest in phosphoric acid among pulses.
- It is comparatively more tolerant to waterlogging and moisture stress than green gram.
- Owing to its salt tolerance, it can be grown in moderate saline and alkali soils. The crop can be successfully grown in soils with pH 5 to 8.
- It is also an important crop for cultivating as '*Paira Crop*' in paddy.
- Blackgram has deep root system which binds the soil particles very tightly and also acts as cover crop and protects the soil from erosion.
- Black gram, being leguminous crop has the capacity of fixing atmospheric nitrogen and enriches the soil with nitrogen and organic matter.



- Leaves mottled with characteristic silvering in pulses is due to the attack of thrips.
- Infested pod becomes malformed and withered due to the attack of aphids.
- Premature defoliation, development of sooty mould, shedding of flowers and pods in pulses is due to whitefly.

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Barley



- Botanical Name: *Hordeum vulgare* L.
- Family :Poaceae/graminae
- Origin : India

- Barley is an important *Rabi* crop of northern plains of India.
- It is commonly grown in the states of UP, Rajasthan, MP, Bihar, Punjab, Haryana, HP and J&K.
- Barley thrives well in marginal, saline or alkaline soils and in water scarce areas as rainfed crop.

Nutritional Value: High quantity of digestible fiber (4%) which control Cholesterol, blood pressure and improve digestion.



Soil:

- Loam soil with 7 to 8 pH is the most suitable types for barley cultivation, however, it may be grown on a variety of soil types, viz; saline, sodic and lighter soils.
- Medium fertile soil- Good for barley cultivation
High fertile soil - Lodging and poor yield



Climate:

- Winter season crop.
- A temperature of 12-15⁰C is congenial for growth and 30⁰C for maturity.
- It can not tolerate frost at any stage of growth.
- High degree of tolerance to drought and sodic conditions.



Field Preparation:

- Two to three ploughing with cultivator followed by planking.
- In case of saline soils, field preparation should be completed about 10 days before sowing. This results in an upward movement of soluble salts from root zone and ensures quick germination and better growth of plants.



Sowing Management:

Production Condition	Seed Rate (kg/ha)	Time of Sowing	Spacing (cm)
Irrigated Timely sown	100	10-25 November	23
Irrigated Late sown	125	26 Nov.-31 Dec.	18
Rainfed Plains	100	25 Oct.-10 Nov.	23
Rainfed Hilly Region	100	20 Oct.-7 Nov.	23



Seed Treatment:

- For the control of loose smut (Kangiari), seed should be treated with vitavax or bavistin @2g/ kg seed.
- The covered smut can be controlled by seed treatment with 1:1 mixture of thiram + bavistin or vitavax @ 2.5g per kg or 1gm raxil/kg seed.
- Termite problem is observed in many fields, treat the seed with 150 ml of chloropyriphos (20 EC) or 250 ml formathion in 5 litre of water for 100 kg of seeds.

Sowing Method: Sowing should be done in rows by seed cum fertilizer drill.

Depth of Sowing: 4 to 5 cm.

**Varieties:**

Production conditions	Variety	Maturity days	Av. Yield (q/ha)
Irrigated – Timely sown	R.D. 2552	132	40.5
	R.D. 2035	128	39.1
	K. 508	127	38.9
	D.L. 88	129	39.7
Irrigated -Late sown	R.D. 2508	130	34.1
	D.L. 88	126	39.1
Rainfed-Timely sown	R.D. 2508	130	34.7
	K. 560	131	35.1
	K. 603	131	35.6
	Lakhan	130	37.2
	J.B. 58	128	38.4
Saline & Sodic	D.L. 88	127	38.5
Malt barley	B.C.U. 73	128	36.8
	Alfa 93	124	35.7



Nutrient Management:

Production Condition	Nutrient Requirement (kg/ha)	
	Nitrogen	Phosphorus
Irrigated timely sown	60	30
Irrigated late sown	60	30
Rainfed plains	30	20
Rainfed hilly regions	40	20

- In case of irrigated condition, half of the nitrogen and full dose of phosphorous should be applied as basal and remaining half of the nitrogen should be top dressed after first irrigation or 30 days after sowing.
- In case of light soils, one third of nitrogen and full dose of phosphorous should be applied as basal, one third of nitrogen after first irrigation and rest one third of nitrogen after second irrigation.



Irrigation Management:

- Barley requires 2-3 irrigation for better yield.
- The critical stages for irrigation are active tillering (30-35 DAS), booting stage/grain filling stage/panicle emergence stage (60-65 DAS) and milk stage (80-85 DAS).
- In case water is available for 1 irrigation – Active tillering stage
- In case water is available for 1 irrigation – active tillering + milk stage



Weed Management:

➤ Cultural practices like hoeing, hand weeding after first irrigation (30-35 DAS). But it is more labour consuming operation.

Type of Weeds	Weedicides	Dose/ ha.	Method of Application
Broad Leaf <i>Chenopodium album</i> (Bathua) <i>Convolvulus arvensis</i> (Hirankhuri) <i>Anagalis arvensis</i> (Krishna Neel) <i>Cronopus didymus</i> (Wild Carrot)	Metsulfuron methyl 2,4-D (Na-Salt 80%) 2,4-D (Easter 38%)	10 gm 625 gm 1300 gm	30-35 day after sowing in 800 liters of water
Narrow Leaf <i>Avena fatua</i> (Wild Oat) <i>Phalaris minor</i> (Kanki)	Isoproturan (75 % WP) Pendimethillin (30% EC) Pinoxaden (5% EC)	1300 gm 3.33 litres 87.5 ml	30-35 day after sowing in 800 liters of water
Both (Broad & Narrow Leaf)	Isoproturan 75% WP + 2,4-D (Easter 38%)	1000 gm 750 gm	30-35 day after sowing in 800 liters of water



Plant Protection Measures

Disease Management:

(1) Loose and covered smut:

- Seed treatment with Vitavax/Bavistin @ 2g/kg seed for loose smut, and Vitavax & Thiram in the ratio of 1:1 or Tebuconazole 1.5 g/kg seed for covered smut.
- Soak the seed for four hours in water and keep it in sunshine for 10-12 hours during May-June. Afterwards, store the seeds in a dry place. In the field, collect the smutted earheads and burn them outside the field.

(2) Rust:

- The use of resistant varieties is highly recommended.
- Spraying with Tilt 0.1% or Bayleton 0.1% or Folicur 0.1% (1 ml in 1 litre water) immediately after appearance of the disease should be done.



(3) Leaf Blight

- It is severe in areas where the day is warm and humid especially in north eastern parts.
- The source of inoculum is both soil and seed and therefore seed treatment with Vitavax and Spraying with Bayleton 0.1% or Tilt @ 0.1% or Folicur 0.1% (1 ml/litre of water) is recommended.
- Grow resistant/tolerant varieties.

(4) Molya: Grow resistant varieties like RD2052 and RD2035.

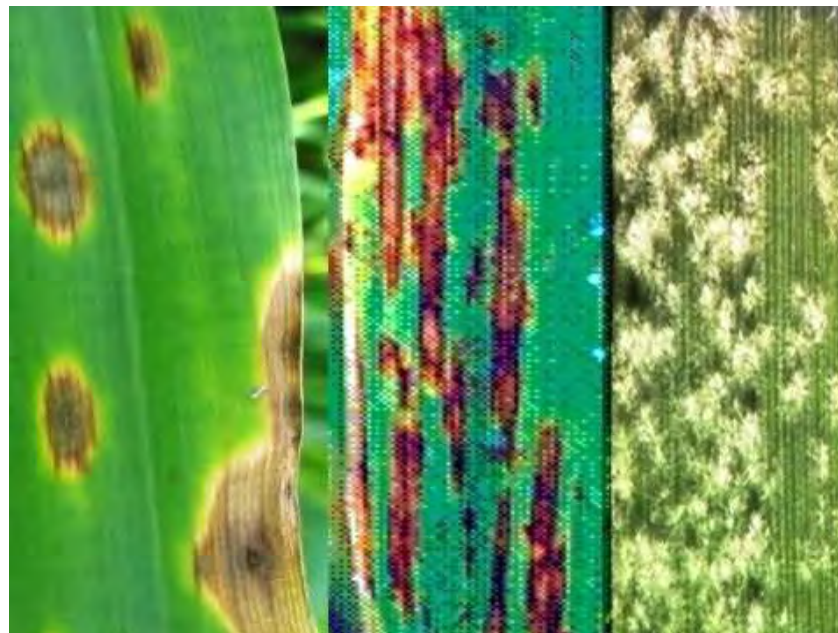
Insect Management:

(1) Aphid:

- Spraying with Imidacloprid @ 20 g ai/ ha or Clothianidin @ 15 g ai/ha in 1000 litres of water. In case of heavy incidence the second spray can be made at an interval of 15 days.
- **Termite: (see in seed treatment chapter)**



Yellow Rust



Leaf Blight



Loose smut and covered smut



Harvesting, threshing and storage:

- Crop gets ready for harvest by the end of March to first fortnight of April.
- Since barley has shattering character, it should be harvested when it ripens (at 18-20% moisture content of grain) to avoid breaking of spikes due to dryness.
- Barley grain absorbs water from the atmosphere and should be stored at an appropriate dry place to avoid storage pest losses.
- Combines are now available which may harvest, thresh and clean the seed in one pass only.

Grain Yield:

Irrigated crop – 40-45 q/ha

Rainfed crop - 20-25 q/ha

Thanks