LECTURE 2 & 3
WHEAT
TRITICUM SP.

Origin
- De Candolle believed – Valley of Euphrates and Tigris
- But Vavilov
  - Origin of Durum wheat probably Abyssinia
  - Soft wheat groups – In the region of Western Pakistan, SW Afghanistan, and S parts of mountainous Babshara

Importance
- World’s number one cereal in area
- Cultivation of wheat is as old as civilization
- It is the first mentioned crop in Bible
- Used for bread, cakes, bakeries, also manufacture of dextrose, alcohol etc
- A nutritious food of all

Classification of wheat
- Genus *Triticum* can be classified into 3 groups
  - Diploids = 7 pairs of chromosomes
  - Tetraploids = 14 pairs
  - Hexaploids = 21 pairs

Commonly cultivated wheat sp
- There are 7 in the world, only 4 is important in India, they are:
  - Common wheat (*T vulgare / aestivum*)
    - Bread wheat
    - Most suited for chapati and bakery
    - Cultivated throughout India
    - Common wheat may be sub-divided
      - Hard red winter wheat – commercial class
      - Hard red spring – where winter is too severe, high protein and excellent bread making characteristics
      - Soft red winter – grown in humid conditions, grains are soft, low protein, flour more suitable for cakes, cookies
      - White wheat – mainly for pasty purpose
- **Duram** (*T durum*)
  - Macroni wheat
  - Best suited for noodles, vermicelli
  - Spring habit
  - Cultivated in Central & Southern India

- **Emmer wheat** (*T dicoccum*)
  - Winter / spring wheat
    - Wheat suitable for TN
    - Preferred for granular preparation
    - Gujarat, Maharastra, AP & TN
**Shot wheat (T sphaerococcum)**

- Indian dwarf wheat
- Practically gone out of cultivation due to low productivity
- Small extent N. India and W Pak for local consumption

**Varieties**

- Sonak – to replace Sonalika
  - HD 2285
  - PBW 343, HD 2687, WH 542, UP 2336, Raj 3077, CPAN 3004, PDW 215
  - Many more like
    - Varieties for irrigated late sown
    - Varieties for salt affected areas etc

**Adaptation and distribution**

- Widely cultivated cereal
- 47ºS to 57ºN latitude
- Cultivated in wide range of soils but
- Well suited to fertile well drained silt and clay loam soils
- Poorly suited to sandy or poorly drained soils

**Climate**

- Wheat has hardening ability after germination
- It can germinate at temp just above 4ºC
- After germination it can withstand freezing temperatures by-
  - Spring wheat - as low as (-9.4ºC)
  - Winter wheat – as low as (-31.6ºC)
- Normal process starts above 5ºC under the presence of adequate sunlight
- During the process of hardening there is gradual increase in the dry matter, sugars, amide nitrogen, and amino nitrogen in the tissues
- As a result there is greater tolerance to freezing of proteins
- Hardened plants have lower moisture in the leaves and
- Water is held more tightly within the cells

**Response to photo period and growth**

- It is long day plant
- Long day hastens the flowering
- Short day increase the vegetative period
– But no more varieties after the release of photo-insensitive

❖ Temperature and growth
– Wheat can be exposed to low temp during vegetative and high temp and long days during reproductive phases
– Optimum is 20-22ºC
  » Optimum for vegetative – 16-22 º C
  » Leaves are largest at 22 º C
– Temp above 22 ºC decreases the plant height, root length and tiller number
– Heading is accelerated as temp rose from 22 to 34 ºC but retarded above 34 ºC
– At grain development 25 ºC for 4-5 weeks is optimum
  » Temp above 25 ºC reduce the grain weight

Growth stages in wheat in North India
❖ Vegetative
– Germination : 5-7 days
– CRI : 20-25 DAS
– Tillering: from 15 days at 4-5 days until 45 DAS
– Jointing: Peak plant growth 45-60 DAS
  » Internode elongation period

❖ Reproductive
– Boot leaf 70-75 DAS
– Flowering : 85-90 DAS
– Milking: 100-105DAS
– Dough: 105-110
– Maturity: 115 – 120
Coordinating Research Zones
- There are 6 zones in India for wheat improvement and coordination
  - Northern Hills Zone
  - North Western Plains Zone
  - North Eastern Plains Zone
  - Central Zone
  - Peninsular Zone
  - Southern Hills Zone

Different growth stages of wheat
Wheat cultivation practices

- **Season**
  - Time of sowing decides yield potential in wheat
  - Irrigated long duration varieties (135-140d)
    - Nov 10-30th
  - Short duration varieties (120-125) may be sown up to Dec 15
Later than Dec 15th there is drastic reduction in yield
Zone wise there is slight variation

❖ Field preparation
- Usually after harvest of Kharif crops
- Field is prepared by disksing once and harrowing
- Moderate to fine tilth is suitable
- Zero tillage also possible
  » After rice dibbling in lines may be an option

❖ Methods of sowing
- Broad casting
- Zero / No-tillage sowing
- Behind the plough
- Drilling
- Dibbling
- FIRB – Furrow irrigated raised bed system
Seed rate

- Normal recommendation 100-125 kg/ha
- Increase seed rate by 25% when
  » Under late sown
  » When the soil moisture is less
- Broadcast requires higher seed rate – 150 kg
- For dibbling 25-30kg is sufficient

Spacing

- Varies with varieties
- Tillering variety requires wider spacing
- Irrigated wheat spaced 22.5 cm and 8-18 cm between plants
- Rainfed wheat – 25-30 cm x 5-6cm
- When late sown closer spacing 15-16cm

Mineral Nutrition

Nitrogen

- Critical leaf N conc is 2.5%
- Poor tillering and small ear heads are deficiency
- Indian soils lack N
- General recommendation
  ✓ For irrigated crop -s 120-150 kg
  ✓ Rainfed - 40-60kg
- Irrigated 2-3 equal splits
  ✓ Heavy soils 2 splits
  ✓ Light soils three
  » Basal, 1st irrigation and 2nd irrigation are time
  » In rainfed crop if moisture availability is sufficient
    ✓ Additional dose may be – 40kg/ha
  » All the nitrogenous may be used
  » For calcareous and strongly alkaline soils
    ✓ Ammonium sulphate is better than Urea
- **Phosphorous**
  - It is also critical nutrient particularly for dwarf
  - If adequate P fertilization is done for
    - ✓ Maize-wheat
    - ✓ Sorghum – wheat
    - ✓ Rice-wheat
  - P may be reduced or avoided
  - But most of soils are responding
  - May be 0.1% dry leaf P conc be maintained
  - 60kg P$_2$O$_5$ at planting is good
  - Source wise water soluble is preferred
  - Rock phosphate efficiency much lower
  - For acid soils
    - ✓ Use of rock phosphate with pyrites may be useful
  - When the water soluble (SSP / DAP) when placed near the root zone is more efficient than broadcasting
  - All P as basal

- **Potassium**
  - There is response to applied K
  - In general Indo-Gangetic alluvium is rich in K and not recommended with K
  - General recommendation is 40-60kg /ha
  - May be basal or split along with 1st irrigation

- **Micro-nutrients**
  - Zn, Fe, Cu, Mn and B are reported as deficient in certain soils and conditions
  - Zn is widely reported
    - ✓ <10ppm in leaves is acute deficiency
    - ✓ Higher P is interfering with Zn
    - ✓ Generally 25 kg Zn SO4 /ha
Foliar spray with 0.5%
5kg ZnSO4 along with 2.5kg slaked lime is dissolved in 1000 lit to spray 1 ha

INM
- Green manure / FYM applied to Kharif crop
- A pulse crop before wheat
- Biofertilizers along the seeds and soil

Irrigation
- Highly responds to irrigation
- 4-6 irrigations are essential
- 40-50% depletion of ASM
- Appropriate IW : CPE ratio for wheat 0.7-0.9
- On clay loam up to 80% depletion
- Critical phases for irrigation are
  - CRI – 20-25 DAS)
  - Second most critical stage – Flowering
  - Third important stage – jointing and milk stages

For varying number irrigations

<table>
<thead>
<tr>
<th>No of irrigations</th>
<th>Stages</th>
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<tbody>
<tr>
<td>1</td>
<td>CRI</td>
</tr>
<tr>
<td>2</td>
<td>CRI + LJ</td>
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</tr>
<tr>
<td>3</td>
<td>CRI + B + M</td>
</tr>
<tr>
<td>4</td>
<td>CRI + LT + F + M</td>
</tr>
<tr>
<td>5</td>
<td>CRI + LT + LJ + F + M</td>
</tr>
<tr>
<td>6</td>
<td>CRI + LT + LJ + F + M + D</td>
</tr>
</tbody>
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*CRI – Crown root initiation; LT – Late tillering; LJ – late jointing; F- Flowering; M- milking; D – Dough stages*

**Weed control**
- Deadly competitor
- Should be controlled at the early
- Better field maintenance to previous crop
- Problematic mono-cot weeds are
  - *Phalaris minor* – (Canary grass)
  - *Avena fatua* (Wild oat)
  - *Polypogon monspliensis*
- Hand weeding is recommended
  - Before 20-25DAS
  - Second weeding 2 weeks later
- Use of herbicides becomes handy
  - Dicots can be controlled by 2,4 D (EE) 0.3-0.4 kg/ha at 35DAS
  - Monocots can be controlled by
    - Isoproturon 1-1.5 kg/ha or
    - Methabenzthiazuron 1.5 kg or
    - Metoxuron 1.5 kg/ha on 30-35 DAS
  - Pre-emergence application of Pendimethalin or Isoproturon is broad spectrum control

**Harvesting and threshing**
- Yellow and dry straw is visual indicator
- Shredding, breaking of spikes are over ripe
- Most suitable stage is grain moisture of 20-25%
- Combine harvester is ideal
- Usually manually harvested or by reapers is dried for 3-4 days on threshing floor and threshed
**Wheat based cropping systems**

- Normally wheat is cultivated after Kharif crops under double crop sequence
- Kharif crops may be
  - Rice, maize, sorghum, millet, mungbean, urdbean, cowpea, pigeonpea, cotton etc.,
- A third crop of any catch crop is raised in certain pockets
- In UP wheat is alternated with sugarcane

**Multiple choice questions**

1. Bread wheat is ____________
   a. *Secale cereale*  
   b. *Hordeum vulgare*  
   c. *Triticum aestivum*

2. According to Vavilov the origin of Durum wheat is ____________
   a. *Abyssinia*  
   b. Asia  
   c. Africa

3. Permanent adventitious roots of wheat is called ____________
   a. Primary roots  
   b. Secondary roots  
   c. Clonal roots
4. Common wheat is ________

5. Durum wheat is ________

6. Emmer wheat is ________

7. Wheat is a ___________ plant
   a. Short day   b. long day   c. day neutral

8. Duration of CRI stage in wheat is ________ DAS
   a. 45-60   b. 20-25   c. 30-45

9. Duration of boot leaf stage in wheat is ________ DAS
   a. 45-60   b. 70-75   c. 30-45

10. Duration of flowering stage in wheat is ________ DAS
    a. 85-90   b. 70-75   c. 100-105

11. Duration of milking stage in wheat is ________ DAS
    a. 85-90   b. 70-75   c. **100-105**

12. Duration of dough stage in wheat is ________ DAS
    a. **105-110**   b. 115-120   c. 100-105

13. Duration of maturity stage in wheat is ________ DAS
    a. 105-110   b. **115-120**   c. 100-105

14. Normal recommendation of seed rate for wheat is ________ kg/ha
    a. 75-90   b. 90-100   c. **100-125**

15. The recommended seed rate for wheat under dibbling method is ________ kg/ha
    a. 25-30   b. 30-45   c. 45-60

16. General recommendation of inorganic fertilizers for wheat is ________ kg/ha

17. Spacing for irrigated wheat is ____________
    a. 22.5 x 8-18 cm   b. 25-30 x 5-6cm   c. 25 x 15 cm

18. Spacing for rainfed wheat is ____________
    a. 22.5 x 8-18 cm   b. **25-30 x 5-6cm**   c. 25 x 15 cm