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 *Tricum* 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

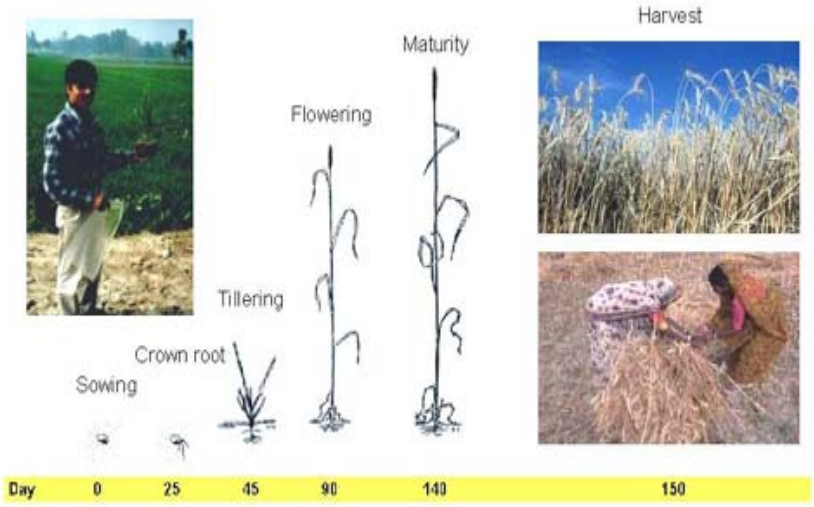
- It is long day plant
- Long day hastens the flowering
- Short day increase the vegetative period

- 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

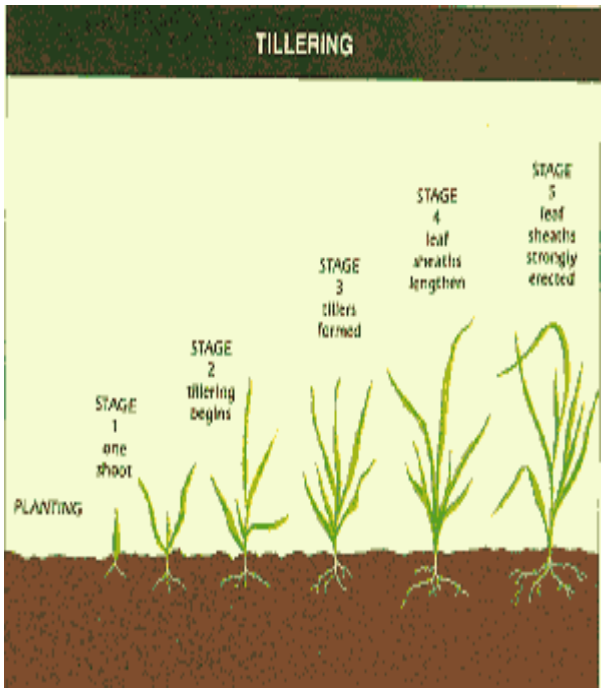
Growth stages in wheat in North India

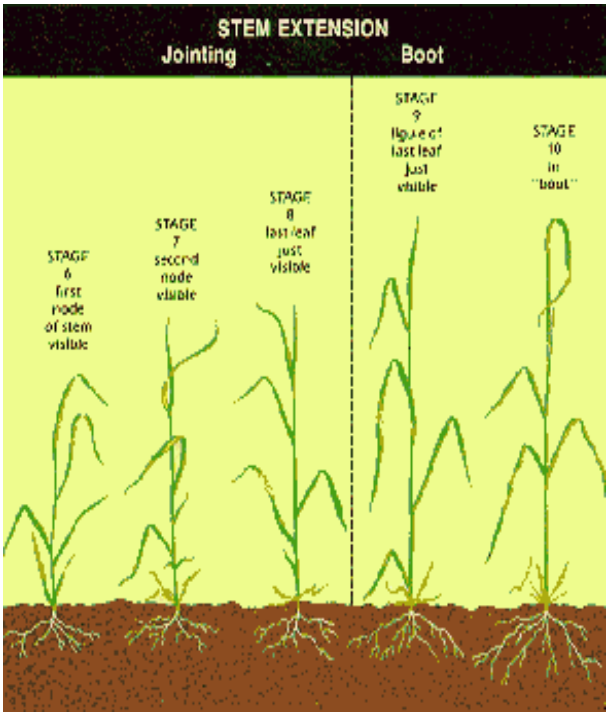
- **Vegetative**
  - Germination : 5-7 days
  - CRI : 20-25 DAS
  - Tillering: from 15 days at 4-5 days until 45 DAS
  - Jointing: Peak plant growth 45-60 DAS
    - Internode elongation period
- **Reproductive**
  - Boot leaf 70-75 DAS
  - Flowering : 85-90 DAS
  - Milking: 100-105DAS
  - Dough: 105-110
  - Maturity: 115 – 120

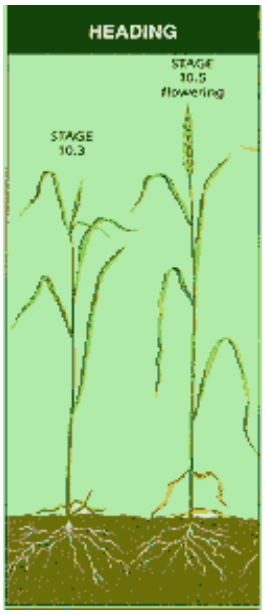


- **Coordinating Research Zones**
  - There are 6 zones in India for wheat improvement and coordination
  - Northern Hills Zone
  - North Western Plans Zone
  - North Eastern Plains Zone
  - Central Zone
  - Peninsular Zone
  - Southern Hills Zone

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 disking 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 calcarious 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_2O_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
  - Biofertlizers 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**

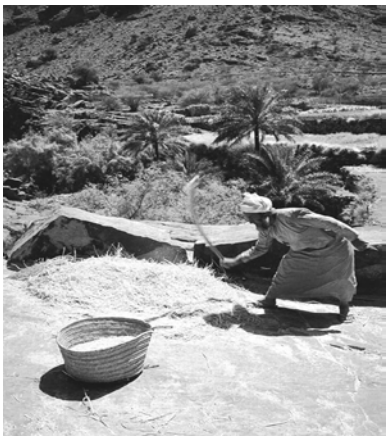
No of irrigations	Stages
1	CRI
2	CRI + LJ

3	CRI + B + M
4	CRI + LT + F + M
5	CRI + LT + LJ + F + M
6	CRI + LT + LJ + F + M + D

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 filed maintenance to previous crop
  - Problematic mono-cot weeds are
    - *Phalaris minor* – (Canary grass)
    - *Avena fatua* (Wild oat)
    - *Polypogan 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 1-1.5kg /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 _____

   a. *Triticum durum* *b. Triticum dicoccum* *c.* ***Triticum aestivum***

5. Duram wheat is _____

   a. Triticum durum *b. Triticum dicoccum* *c. Triticum aestivum*

6. Emmer wheat is _____

   a. Triticum durum ***b. Triticum dicoccum*** *c. Triticum aestivum*

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

    a. **120-150 : 60 : 40-60** b. 130-145 : 65 : 60 c. 145-160 : 65 : 65

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