From Field to Fork: Understanding the Journey of Wheat

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Wheat, scientifically known as Triticum aestivum (2n = 42), is one of the most important cereal grains worldwide and a staple food for a significant portion of the global population. It belongs to the grass family Poaceae and is cultivated in diverse climates across the world. This versatile grain comes in various forms, the most common being bread wheat *Triticum aestivum*, macaroni wheat *Triticum durum*, and emmer wheat *Triticum dicoccum*. It serves as a fundamental ingredient in a wide array of food products, including bread, pasta, couscous, cakes, pastries, and various other baked goods.

The journey of wheat from field to fork is as follows:

Soil tillage and land preparation

Wheat which is usually grown after paddy, maize, sorghum, pearl millet and other kharif pulses requires a well pulverised soil for good germination. The soil is ploughed with mould board plough after kharif crop harvest to bring to a fine tilth as the seed is small. The field is deeply ploughed followed by 2-3 times harrowing or 4-5 inter-cross ploughing with country plough. Planking is done after ploughing to retain the moisture. The number of ploughings depends upon the nature and type of weeds in the field. More number of ploughings is required if there are perennial weeds.

Manures and fertilizer application

Organic manure application in the soil helps in building a good soil structure besides increasing the water holding capacity of the soil. As organic manures do not provide the required amount of nutrients, additional application of fertilizers is required. The recommended dose of fertilizer is about 80-100 kg N, 50-70 kg P2O5 and 30-40 kg K2O/ha depending on the type of wheat. Nitrogen is applied in splits i.e. 2/3rd or half of it is applied at the sowing time and the remaining 1/3rd or half is top dressed at the first irrigation. Phosphorus and potash are applied at the time of sowing in full dose, as the nutrients are less mobile and takes more time to dissociate and delayed availability to the crop.

Seed rate

Seed rate depends on the variety, soil moisture status, sowing method, tillering ability, time of sowing etc. The seed rate for different situations are given below:

(a) Line sowing behind plough: 90-100 kg/ha

(b) Sowing by Kera/pora method: 80-100kg/ha

(c) Sowing by seed dibbling: 25-30 kg/ha

(d) Late sowing by seed drill: 125-155 kg/ha

Seed treatment

Wheat seed should be treated with fungicides like Agrosan GN, Thiram or Vitavax @ 2.5g/kg seed before sowing to protect the seed from the associated diseases.

Sowing method

Bi-directional sowing (second direction sowing cutting across the first sowing direction at right angles) gives yield advantage. Wheat is sown by different methods as below:

(a) Broadcasting: Scattered throwing of the seed followed by harrowing to cover up the seed with soil. This method has several drawbacks like irregular seed establishment and should be avoided.

(b) Behind plough: Seeds are dropped by hand at a depth of 5-6 cm into the furrow created by the country plough by hand (kera method) or by a special attachment to the plough (pora method). Most of the Indian farmers use this method which gives satisfactory germination.

(c) Seed drill: Seeds are sown with seed drills or seed cum fertilizer drill which gives uniform germination and plant stand.

(d) Dibbling: Seeds are dropped into the hole/hill created by a wooden or iron frame with peggs called 'Dibbler'. One or two seeds are dropped by hand into the hole which is time and labour consuming method.

Cropping system

Cropping system is a critical aspect in developing an effective ecological farming system to

manage and organize crops so that they best utilize the available resources (soil, air, sunlight, water, labour, equipments). Wheat is grown mainly in cropping sequences with Rice, Jowar, Bajra, Maize, Pulse, Cotton, Soybean etc. in different parts of the country under irrigated condition. Under rainfed condition, fallow-wheat is most common, but sometimes short duration pulse crops may proceed wheat in assured rainfall areas.

Water management/Irrigation

The various functions of water in plants includes maintaining cell turgidity for structure and growth; transporting nutrients and organic compounds throughout the plant; comprising much of the living protoplasm in the cells; serving as a raw material for various chemical processes, including photosynthesis; and, through transpiration, buffering the plant against wide temperature fluctuations. Irrigation is given to wheat at the most critical stages of the wheat crop. The critical stages of wheat are Crown root initiation/CRI (25-30 DAS), tillering (45 DAS), jointing (65 DAS), booting (75 DAS), flowering (85 DAS), milk stage (90-110 DAS). If farmers afford to give 1 irrigation, it should be at CRI stage, if 2, it should be at CRI and Booting stage, if 3, it should be at CRI tillering and booting stages, if 4, it should be at CRI, tillering, booting and milk stages and if 5, it should be at CRI, tillering, jointing, flowering and milk stages.

Weed Management

Wheat fields are commonly infested with both grasses and broad-leaved weeds. To realize the full yield potential of the wheat crop, proper weed control is essential. Being an irrigated crop, weeds equally have the potential to emerge from the field. The common weeds are grassy weeds (*Phalaris minor, Cynodon dactylon, Avena fatua, Lolium temulentum*), broadleaved weeds (*Chenopodium album, Fumaria parviflora, Melilotus alba, Vicia sativa, Lathyrus aphaca*) and perennial weeds (*Cyperus rotundus, Circium arvense, Convulvulus arvensis*). *Phalaris minor* is the most dreaded weed in most of the wheat growing belts of the country morphologically similar to wheat. Among various methods of weed controls, chemical control can be effective. Pre emergence application of Pendimethalin (Stomp 35% EC) @ 0.75-1 kg a.i./ha just after sowing followed by hand weeding at 25-30 DAS controlled broadleaved weeds while grassy and perennial weeds are effectively suppressed/ controlled by post emergence application of 2,4 D (Ester), Bladex C@, 34% EC) @ 1.4 litre/ha in 800-1000 litre water or Isoproturon/Isoguard @ 0.75 kg a.i./ha in 800-1000 litre water at 30-35 DAS followed by one hand weed weeding would be a suitable integrated weed management system in wheat. Stale seed bed, crop rotation, crop geometry, timely sowing, rouging etc are crop husbandry required for avoiding weeds as a cultural weed control method.

Insect-pest and diseases management

The common insect-pest in wheat are termites, aphids, jassids, rodents etc. Rodents are controlled by mechanical traps or rodenticides like ratafin/warfarin (as a bait). Wheat suffers from several diseases including rust, alternaria leaf blight, powdery mildew, loose smut and karnal bunt. For diseases, precautionary measures are more important than control measures. The following measures are to be taken up before sowing:

(i) Grow resistant varieties as far as possible.

(ii) Treat the seed before sowing with any fungicide (Cerasan, vitavex, Agrosan.

(iii) If the diseases still appears, spray 0.2% Zineb, Dithane M 45 or Bordeaux mixture.

(iv) Keep the field clean (field sanitation) as many of the diseases are soil borne and superficial diseases.

(v) Timely sowing of the crop is mandatory to escape from insect-pest diseases.

Harvesting

When the wheat is fully grown it turns from green to gold — the bright, iconic color wheat is best known for. The plants have dried out and become brittle. This means it is time to harvest the wheat. The crop is harvested before it is dead ripe to avoid yield loss. If it is not harvested in time, grain may be lost/damaged by field rats, birds, insects and through shattering and lodging. The right time to harvest the crop is when the moisture content in grain is 20-25%. Harvesting is usually done by serrated sickle by hand.

Bullock driven reapers, machine driven reapers, combined harvester (cutting, threshing, winnowing at the same time) are also employed.

Threshing

Wheat is threshed after drying the harvested crop for 3-4 days on the threshing floor. Threshing is done by trampling with bullock feet or by power driven thresher. This is used to save time and labour which also has a better output. After threshing, the grains are cleaned winnowed and properly dried for storage in a gunny bag or other suitable materials.

Yield of Wheat

There are research findings that, a high yielding variety of wheat under proper and improved package of practice would give a grain yield of 45-55 q/ha under irrigated and 20- 25 q/ha under rainfed conditions.

Storage

Harvested grains should be stored in a well-constructed storage bin with well aerated structure to avoid damply situation. Insect-pest and diseases are encouraged under such conditions. Storage structures with aluminium/tin roofs are preferable as the heat accumulated help in further drying of the stored grains.

Milling

Once wheat arrives at a flour mill, it is cleaned to remove impurities such as sticks, stones and other course and fine materials. Then it is sent to conditioning bins, where it is soaked in water for easy removal of the bran. The bran is the protective outer shell of the wheat kernel. Conditioning ensures moisture content is uniform throughout the grain because moisture helps to prevent the bran from breaking during milling. Next, different wheat is blended — known to millers as wheat grist. At this stage different wheat batches are mixed to create the specific kind and quality of flour to meet the miller's needs. The wheat is ground by a flour mill machine that crushes it into pieces. It is then put through sifters that separate the endosperm, wheat germ and wheat bran. These can be sold separately or used to produce different flours. For example — wheat bran, wheat germ and white flour blended together creates whole wheat flour.

Consumption

Finally, consumers prepare and consume wheat-based foods as part of their daily meals, snacks, and culinary creations. Wheat products contribute to a diverse array of cuisines worldwide, serving as staples in many cultures.

Conclusion

Throughout this journey, quality control measures, food safety regulations, and industry standards are implemented to ensure that the wheat and wheat-based products meet the required quality, nutritional, and safety standards for consumers. Additionally, technological advancements and sustainable practices are increasingly being adopted across the wheat supply chain to improve efficiency, minimize waste, and reduce environmental impacts.

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