
Production Technique in Field Crops for Higher Yield

Dr. Vinay Kumar Singh* Dr. D. S. Tomar Dr. J. Morya, Shri P. P. Singh******

**Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Krishi Vigyan Kendra,
Jhabua, Madhya Pradesh. India**

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Introduction

Field crops are crops grown on a large scale primarily for food, feed, fibre, oil, sugar, industrial raw materials and other economic purposes. They form the foundation of agriculture and play an important role in food security, employment, livestock production and rural development. Major Field crops include **cereals such as rice, wheat, maize and sorghum; pulses such as chickpea, pigeon pea and lentil; oilseeds such as soybean, groundnut, mustard and sunflower; fibre crops such as cotton and jute; and commercial crops such as sugarcane and tobacco.** The production of field crops involves a series of scientific and carefully planned operations beginning with the selection of a suitable crop and variety and continuing through land preparation, seed treatment, sowing, nutrient management, irrigation, weed control, pest and disease management, harvesting, threshing, storage and marketing. The productivity and profitability of a crop depend on the proper integration of all these operations. Modern crop production aims not only to obtain high yields but also to maintain soil fertility, conserve water, reduce production costs, protect the environment and provide safe agricultural products. Therefore, the concept of **integrated crop production** combines improved varieties, balanced fertilisation, and efficient irrigation, integrated pest management, mechanisation and sustainable farming practices.

1. Selection of Crop and Variety:

The first step in field-crop production is selecting a crop and variety suitable for the particular agro-climatic conditions.

Factors affecting crop selection:

1. **Climate:** Temperature, rainfall, humidity and length of growing season influence crop growth.
2. **Soil:** Soil texture, fertility, pH, drainage and water-holding capacity should be considered.
3. **Availability of irrigation:** Crops requiring large amounts of water should preferably be grown where irrigation facilities are available.
4. **Market demand:** Farmers should consider the demand and expected price of the produce.
5. **Cropping system:** The crop should fit properly into the existing crop rotation.
6. **Farm resources:** Availability of labour, machinery, fertilisers, water and capital should be considered.
7. **Resistance to pests and diseases:** Resistant or tolerant varieties reduce crop losses and pesticide requirements.

Characteristics of an improved variety: An improved variety should have high yield potential, good quality, adaptability to local conditions. The improved variety should exhibit resistance or tolerance to major diseases and insects. Suitable maturity period, Good response to fertilisers, Resistance to lodging where appropriate, Better tolerance to drought, salinity or other stresses when required. Certified or quality seed of a recommended variety should be used for obtaining a healthy and uniform crop stand.

2. Land Preparation: Land preparation provides a suitable physical environment for seed germination and root development. It also helps in controlling weeds and incorporating crop residues and organic manures.

Primary tillage: Primary tillage is generally performed after harvesting the previous crop. Ploughing loosens the soil, breaks compact layers and incorporates crop residues. Common implements include: Mould-board plough, disc plough, country plough, chisel plough. The number of ploughings should be based on soil conditions rather than following a fixed number. Excessive tillage can destroy soil structure, increase erosion and raise production costs.

Secondary tillage: Secondary tillage produces a fine and level seedbed. It may involve harrowing, planking, levelling and cultivator operation. The seedbed should generally be sufficiently fine and moist but should not be excessively pulverised.

Conservation tillage: Modern agriculture increasingly promotes conservation tillage practices such as: Minimum tillage, zero or reduced tillage, residue retention and mulching. These practices can reduce soil erosion, conserve moisture and reduce fuel consumption.

3. Soil Testing and Fertility Management: Soil is the main medium for plant growth and provides plants with water and essential nutrients. Soil testing should be carried out before crop production to determine nutrient status and guide fertiliser application.

Essential plant nutrients are required by plants and can be broadly classified into two categories:

- **Macronutrients:** Nitrogen, Phosphorus, Potassium, Calcium, Magnesium and Sulphur
- **Micronutrients:** Iron, Zinc, Manganese, Copper, Boron, Molybdenum, Chlorine and Nickel. Nutrients should be supplied according to crop requirements and soil-test recommendations.
- **Organic manures:** Organic manures improve soil physical, chemical and biological properties. Important sources include farmyard manure, compost, vermicompost, green manure, crop residues **and** poultry manure. Well-decomposed farmyard manure or compost should preferably be incorporated into the soil before planting.
- **Chemical fertilisers:** Fertilisers provide nutrients in concentrated forms. Common fertilisers include: Urea – nitrogen, diammonium phosphate – nitrogen and phosphorus, Single superphosphate – phosphorus and sulphur, Muriate of potash – potassium, Complex fertilisers – combinations of nutrients. Balanced fertilisation is important because excessive application of one nutrient can create nutritional imbalance and environmental problems.

4. Seed Selection and Seed Quality: Good-quality seed is one of the most important requirements for successful crop production. High-quality seed should have: High germination percentage, Good genetic purity, physical purity, Good vigour, Freedom from seed-borne diseases, appropriate moisture content, and freedom from insect infestation. Seed should be obtained from reliable sources.

Seed treatment: Seed treatment protects young seedlings from seed-borne and soil-borne diseases and may improve germination. Methods include, **namely, fungicide treatment, biofertiliser treatment, insecticide treatment where recommended, and physical treatment.** For legumes such as chickpea, pea, soybean and groundnut, inoculation with appropriate **Rhizobium** cultures can improve biological nitrogen fixation. Other beneficial microbial inoculants may include phosphate-solubilising microorganisms and plant-growth-promoting microorganisms.

5. Sowing: Sowing is a critical operation because crop population and uniformity depend greatly on it.

Important factors in sowing: time of sowing and seed rate. Row spacing, plant-to-plant spacing, depth of sowing, soil moisture and sowing method. The optimum sowing time differs among crops and regions.

Methods of sowing:

- **Broadcasting:** Seeds are scattered over the prepared field. It is simple but may result in uneven plant distribution.
- **Line sowing:** Seeds are placed in rows at recommended spacing. This facilitates includes intercultural operations, weed control, fertiliser placement, irrigation management, and mechanical harvesting.
- **Drilling:** Seed drills place seeds at a relatively uniform depth and spacing.
- **Dibbling:** **Individual** seeds are placed in holes at specified distances. It is useful for crops requiring wider spacing.
- **Transplanting:** Some crops, especially rice, may be established by transplanting seedlings raised in a nursery.

6. Plant Population and Spacing: Proper plant population is essential for optimum yield. If the population is too low, available resources such as sunlight, water and nutrients are not fully utilised. Excessive population can cause competition between plants. The recommended spacing depends on crop species, variety, soil fertility, irrigation, climate, plant architecture and duration of crop. For example, cereals generally require closer spacing than crops such as cotton or pigeon pea.

7. Water Management: Water is essential for germination, photosynthesis, nutrient transport and growth. Both insufficient and excessive water can reduce yield.

- **Sources of irrigation:** Irrigation water may come from wells, tube wells, canals, reservoirs, farm ponds and rivers.
- **Methods of irrigation:**
- **Surface irrigation:** Water is applied over the soil surface. It includes flood irrigation, basin irrigation, border irrigation, and furrow irrigation.
- **Sprinkler irrigation:** **Water** is sprayed through sprinklers and is useful where land is uneven or water availability is limited.
- **Drip irrigation:** Water is supplied directly near the root zone through emitters. It can improve water-use efficiency and is particularly useful for widely spaced crops.
- **Critical stages of irrigation:** Different crops have particular growth stages when water shortage can cause considerable yield reduction. Irrigation should therefore be scheduled according to crop requirement, soil type, weather, crop growth stage, and available water. Over-irrigation should be avoided because it can cause water logging, nutrient leaching, salinity and unnecessary expenditure.

8. Weed Management: Weeds are unwanted plants that compete with crops for water, nutrients, light and space. They can also harbour insects and diseases.

Methods of weed control:

- **Mechanical control:** Weeds may be removed using a hand hoe, wheel hoe, cultivator, inter-row and equipment.
- **Cultural control:** Cultural practices include proper crop rotation, timely sowing, proper plant population, competitive varieties, mulching and clean seed.
- **Chemical control:** Herbicides can control weeds efficiently when used according to the label and crop recommendations. Herbicides may be applied before sowing, pre-emergence **and** post-emergence. Correct selection, dose and application timing are essential.
- **Integrated weed management:** Integrated weed management combines cultural, mechanical and chemical methods to provide effective and economical weed control while reducing dependence on herbicides.

9. Nutrient Management: Nutrient management should be based on the principle of supplying the right nutrient, in the right amount, at the right time and in the right place.

- **Nitrogen management:** Nitrogen promotes leaf development, vegetative growth, protein formation **and** green colour of leaves. Nitrogen is often applied in split doses because excessive nitrogen at one time can lead to losses and excessive vegetative growth.
- **Phosphorus management:** Phosphorus is important for root development, energy transfer, flowering and seed formation. It is generally placed near the seed or root zone according to crop recommendations.
- **Potassium management:** Potassium contributes to water regulation, enzyme activation, disease tolerance, stress tolerance and crop quality. Balanced application of potassium is particularly important in high-yielding crops.
- **Micronutrient management:** Deficiency of micronutrients such as zinc, iron or boron can reduce yield. Their application should be based on soil tests and crop-specific recommendations.

10. Intercultural Operations: Intercultural operations are performed between crop rows after crop establishment. They include hoeing, weeding, earthing up, thinning, gap filling and mulching.

- **Thinning:** Excess plants are removed to maintain the desired plant population.
- **Gap filling:** Where seeds fail to germinate, gaps may be filled with healthy seedlings or plants at an early stage.
- **Earthing up:** Soil is placed around the base of plants. It may provide support and improve root development and drainage in suitable crops.

11. Pest Management: Field crops are attacked by numerous insect pests. Major groups include stem borers, leaf folders, aphids, whiteflies, jassids, bollworms, pod borers, cutworms and termites. Pest management should focus on prevention and monitoring rather than routine pesticide application.

- **Integrated Pest Management (IPM):** IPM combines several approaches like the use of resistant varieties, crop rotation, clean cultivation, timely sowing, balanced fertilisation, biological control, mechanical control, pheromone and light traps where appropriate **and** judicious pesticide application.

Pesticides should be used only when necessary and according to approved recommendations and label directions.

12. Disease Management: Field crops can suffer from fungal, bacterial, viral and nematode diseases. Common disease-management practices include the use of disease-free seed, resistant varieties, seed treatment, crop rotation, proper field sanitation, Removal of severely infected plants where appropriate Proper irrigation, balanced fertilisation, biological control and recommended fungicides or other plant-protection products when required. Early identification of disease symptoms is important because management is usually more effective when initiated at an early stage.

13. Crop Rotation: Crop rotation means growing different crops sequentially on the same land according to a planned sequence. For example, like **cereal** → **pulse** → **oilseed**. Crop rotation provides several benefits for maintaining soil fertility and breaking pest and disease cycles. Improves soil structure, helps manage weeds, improves nutrient-use efficiency and reduces dependence on a single crop. Leguminous crops such as chickpea, pigeon pea and soybean can contribute nitrogen to the cropping system through biological nitrogen fixation.

14. Major Field Crops and Their Production Practices:

A. Rice: Rice is one of the most important food crops. It grows well under warm and humid conditions.

Major production practices:

1. Select a suitable high-yielding variety.
2. Prepare the nursery where transplanting is practised.
3. Treat seed as recommended.
4. Establish a healthy nursery.
5. Prepare and level the main field.
6. Apply organic manure and fertilisers according to soil-test recommendations.
7. Transplant healthy seedlings at the recommended age and spacing, or use direct-seeded methods where suitable.
8. Maintain appropriate soil moisture and water management.
9. Control weeds at the critical early stage.
10. Monitor insects and diseases.
11. Drain the field appropriately before harvest.
12. Harvest when grains reach suitable maturity.
13. Dry and store grain properly.

B. Wheat: Wheat is mainly a cool-season cereal crop.

Production practices:

- Prepare a fine but firm seedbed.
- Use quality seed of a suitable variety.
- Sow at the recommended time.
- Maintain proper seed rate and row spacing.
- Apply fertilisers based on soil-test results.

- Irrigate at critical growth stages.
- Control weeds during early crop growth.
- Monitor for rusts, aphids and other important pests.
- Harvest when the crop reaches physiological maturity and grain moisture is suitable.

C. Maize: Maize is a versatile cereal used for food, animal feed and industrial products.

Production practices:

- Select well-drained fertile soil.
- Prepare the land properly.
- Use quality hybrid or improved seed.
- Sow in rows at recommended spacing.
- Apply balanced nutrients.
- Maintain adequate moisture, particularly during sensitive growth stages.
- Control weeds during early crop growth.
- Monitor for fall armyworm and other pests where relevant.
- Harvest according to the intended use.

D. Sorghum: Sorghum is an important cereal and fodder crop, particularly in relatively dry areas. Important practices include selection of drought-tolerant varieties, timely sowing, proper plant population, balanced fertilisation, weed management, and monitoring shoot flies, stem borers and diseases and timely harvesting.

E. Chickpea: Chickpea is an important pulse crop grown mainly during the cool, dry season. **Important Production practices**

- Use disease-free quality seed.
- Select well-drained soil.
- Treat seed appropriately.
- Inoculate with suitable Rhizobium where recommended.
- Sow at the recommended time.
- Maintain appropriate spacing.
- Apply nutrients according to soil-test recommendations.
- Avoid excessive irrigation.
- Monitor pod borer and major diseases.
- Harvest when most plants mature and pods become dry.

F. Pigeon Pea: Pigeon pea is a major pulse crop with good adaptation to rainfed agriculture.

Important practices include:

- Use suitable early, medium or long-duration varieties depending on the growing season.
- Maintain recommended spacing.
- Use seed treatment and microbial inoculation where appropriate.
- Apply balanced nutrients.
- Manage weeds during early growth.

- Monitor pod borer and wilt.
- Harvest when pods and plants reach maturity.

G. Soybean: Soybean is an important oilseed and protein-rich crop.

Production practices

1. Select well-drained soil.
2. Use high-quality certified seed.
3. Treat seed with appropriate seed-treatment agents.
4. Inoculate the seed with a suitable Bradyrhizobium/Rhizobium inoculant as recommended.
5. Sow at the recommended time when adequate soil moisture is available.
6. Maintain proper row spacing and plant population.
7. Apply balanced nutrients based on soil-test recommendations.
8. Manage weeds effectively during the early crop-growth period.
9. Monitor defoliating insects, pod pests and diseases.
10. Avoid unnecessary irrigation in poorly drained soils.
11. Harvest when pods are mature and seeds have attained suitable moisture.
12. Dry and store seed properly.

H. Groundnut: Groundnut is an important oilseed and food crop. Production involves:

- Selection of suitable sandy loam or well-drained soil
- Good-quality seed
- Seed treatment
- Proper sowing depth and spacing
- Balanced nutrient application
- Weed management
- Earthing-up where recommended
- Management of leaf spots, rust and insect pests
- Timely harvesting
- Proper drying to prevent fungal contamination and deterioration

I. Mustard: Mustard is an important winter oilseed crop.

Production practices

- Prepare a fine and well-levelled seedbed.
- Use a recommended variety.
- Sow at the appropriate time.
- Use proper seed rate and spacing.
- Apply nutrients according to soil-test recommendations.
- Control weeds during the early stage.
- Monitor aphids and diseases such as white rust and Alternaria blight.
- Irrigate when required.
- Harvest when siliquae mature but before excessive shattering occurs.

J. Cotton: Cotton is a major fibre crop.

Important production practices

- Select suitable soil and variety/hybrid.
- Use quality seed.
- Maintain recommended plant population.
- Apply nutrients according to crop demand and soil-test results.
- Manage weeds effectively.
- Maintain adequate moisture.
- Monitor bollworms, sucking pests and diseases.
- Follow integrated pest management.
- Harvest mature opened bolls at suitable intervals.
- Keep harvested cotton clean and dry.

K. Sugarcane: Sugarcane is a long-duration commercial crop used mainly for sugar production.

Production practices

- Select healthy, disease-free planting material.
- Prepare the field thoroughly.
- Plant setts or other recommended planting material.
- Maintain suitable spacing.
- Apply organic manure and balanced fertilisers. Irrigate according to soil and climate.
- Control weeds during early growth.
- Earthing-up may be carried out where recommended.
- Monitor major pests and diseases.
- Harvest at proper maturity.

15. Harvesting: Harvesting is the process of collecting the mature crop from the field. Harvesting at the correct stage is essential for maintaining yield and quality. **During signs of maturity** different crops show different maturity indicators: Change in grain colour, drying of leaves, hardening of grain, drying of pods, and opening of bolls and change in moisture content. Harvesting too early can result in immature produce and lower quality. Delayed harvesting may cause shattering, lodging, bird damage, insect damage, weather losses, and quality deterioration.

16. Threshing and Winnowing

- **Threshing:** Separates grain or seed from harvested plant material. It may be carried out manually or with machines such as threshers, combine harvesters **and** crop-specific harvesting equipment.
- **Winnowing:** Separates grain from chaff and lighter materials using air movement. Proper threshing reduces grain damage and contamination.

17. Post-Harvest Management: Post-harvest losses can be significant if harvested produce is not handled correctly. Important operations include cleaning, drying, grading, packaging, storage, transportation and processing.

- **Drying:** Grain must be dried to a safe moisture level appropriate for the crop and storage conditions. Excess moisture encourages fungal growth, insect infestation, heating, loss of germination, and quality deterioration.
- **Storage:** Storage structures should be clean, dry, well ventilated where appropriate, protected from rodents, protected from insects, and free from moisture leakage. Hermetic storage and improved grain-storage technologies can reduce losses when appropriately used.

18. Mechanisation in Field Crop Production: Agricultural mechanisation reduces labour requirements and improves the timeliness of farm operations. Machines may be used for land preparation, sowing, fertiliser application, weeding, spraying, harvesting, threshing, and transportation. Examples include tractors, seed drills, planters, power weeders, sprayers, reapers, combine harvesters, and threshers. Appropriate mechanisation should consider farm size, crop type, terrain, labour availability and cost.

19. Sustainable Production of Field Crops: Sustainable crop production seeks to maintain productivity while conserving natural resources. Important practices include:

- **Soil conservation:** Contour farming, strip cropping, mulching, cover crops, reduced tillage, residue management
- **Water conservation:** Drip irrigation, sprinkler irrigation, rainwater harvesting, farm ponds, proper irrigation scheduling **and** mulching.
- **Nutrient conservation:** Soil testing, organic manure, crop rotation, legume inclusion and balanced fertiliser application.
- **Biological approaches:** biofertilisers, biopesticides, beneficial insects **and** microbial inoculants. These practices can reduce environmental impacts while maintaining productivity.

20. Precision Agriculture: Precision agriculture uses information and technology to manage crops according to field variability. Technologies may include GPS, remote sensing, drones, soil sensors, satellite imagery, variable-rate fertiliser application **and** digital weather information. Precision farming can help farmers identify nutrient deficiencies, water stress, pest outbreaks and crop variability. It can improve the efficiency of inputs when appropriately implemented.

21. Integrated Crop Management: Integrated Crop Management (ICM) combines different production practices to obtain sustainable and profitable yields. It includes suitable crop and variety, quality seed, proper land preparation, timely sowing, balanced nutrition, efficient irrigation, weed management, integrated pest management, disease management, crop rotation, mechanisation, proper harvesting **and** post-harvest management. The objective is not simply to maximise production through heavy input use but to **optimise productivity, profitability and resource conservation**.

22. Climate-Smart Field Crop Production: Climate variability creates challenges such as drought, heat stress, irregular rainfall, floods and new pest patterns. Adaptation practices include drought-tolerant varieties, short-duration varieties, water-saving irrigation, conservation agriculture, crop diversification, weather-based crop management, improved soil organic matter, crop residue management, rainwater harvesting and integrated pest management. Climate-smart production aims to improve resilience while reducing unnecessary environmental impacts.

Conclusion: Production of field crops is a complex process involving several interconnected activities from **crop and variety selection to post-harvest storage**. Successful production requires proper land preparation, quality seed, timely sowing, balanced nutrient management, efficient water use, and weed control, integrated management of insects and diseases, and timely harvesting. Different crops have different environmental and management requirements. Therefore, crop production practices should always be adapted to local soil, climate, water availability, and variety and farming conditions. Modern approaches such as conservation agriculture, integrated crop management, precision agriculture, improved irrigation and biological inputs can help improve resource-use efficiency and sustainability. The future of field-crop production depends on combining scientific knowledge with locally appropriate farming practices. Sustainable production should aim for **higher and stable yields, better farm profitability, efficient use of water and nutrients, reduction of production losses, conservation of soil and biodiversity, and protection of the environment**. Through appropriate technology and good management, field crops can continue to provide food, fibre, feed and industrial raw materials for a growing population.

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