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Groundnut Cultivation and Economic Significance

Dr. Uday Kumar, *Dr. Anand Kumar Jain, Shaheen Naz, Dr. Suman Kalyani, Dr. Ranvir Kumar, Dr. Prem Chand Kumar and Dr. Beerendra Singh
Bihar Agricultural University Sabour (Bhagalpur)-813210, Bihar
***Corresponding Author's email: dranandkumarjain@gmail.com**

The groundnut (peanut) scenario involves India leading global production, with major production hubs in Gujarat, Rajasthan, and Tamil Nadu, facing challenges like water stress and pest management, while relying on both rainfed and irrigated methods, with increasing demand for processed products and exports to Southeast Asian nations, requiring focus on sustainable IPM (Integrated Pest Management) and post-harvest quality. Groundnut is one of India's major oilseed crops, ranking second in both area and production after soybean (2024–25, Government of India). On the global stage, China is the leading producer of groundnut with an output of 19.27 million tonnes, accounting for 35% of the total world production of 54.31 million tonnes in 2023. India follows with 10.30 million tones (19%), trailed by Nigeria (4.30 million tonnes, 8%), the United States (2.67 million tonnes, 5%), and Myanmar (1.79 million tonnes, 3%). Within India, the major groundnut producing states are Gujarat, Rajasthan, Andhra Pradesh, Karnataka, and Tamil Nadu. According to the third advance estimates for 2024–25, India's total groundnut production (including both kharif and rabi crops) is projected at 118.96 lakh tonnes, marking an increase from 101.80 lakh tonnes recorded in 2023–24. Among the states, Gujarat continues to lead with an estimated production of 51.81 lakh tonnes, followed by Rajasthan (21.24 lakh tonnes), Madhya Pradesh (15.75 lakh tonnes), Tamil Nadu (7.56 lakh tonnes), Karnataka (4.44 lakh tonnes), and Telangana (2.30 lakh tonnes). Peanut or groundnut (Arachis hypogaea) is a species in the legume or "bean" - (Fabaceae) family. The peanut was probably first domesticated and cultivated in the valleys of Paraguay. It is an annual herbaceous plant growing 30 to 50 cm (1.0 to 1.6 ft) tall.

India is the second-largest producer of groundnuts in the world. Indian groundnuts are available in different varieties: Bold or Runner, Java or Spanish and Red Natal. The main Groundnut varieties produced in India are Kadiri-2, Kadiri-3, BG-1, BG-2, Kuber, GAUG-1, GAUG-10, PG-1, T-28, T-64, Chandra, Chitra, Kaushal, Parkash, Amber, etc.

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Groundnut (peanut) is economically significant as a vital cash crop providing edible oil, protein-rich food (snacks, peanut butter, RUTF for malnutrition), and livestock feed (oil cake), while also boosting farm income, improving soil fertility through nitrogen fixation (reducing fertilizer costs), and supporting industries like cosmetics, pharmaceuticals, and biofuel, with its shells used for fuel or construction. It generates foreign exchange, empowers women through processing, and serves as a crucial rotation crop for sustainable agriculture.

For Farmers & Economy

- **Cash Crop & Income:** A major cash crop, especially in India (where it's called the "king of oilseeds"), providing year-round income and supporting livelihoods, particularly for women through processing.
- **Soil Improvement:** As a legume, it fixes atmospheric nitrogen, enriching soil and reducing the need for synthetic fertilizers for subsequent crops, promoting sustainable farming.
- **Rotation Crop:** Its ability to improve soil fertility makes it an excellent crop for rotation, enhancing overall farm productivity.
- **Trade:** Export of groundnut products (oil, butter) generates foreign exchange for producing nations.

For Food & Nutrition

- **Edible Oil:** A primary source of cooking oil due to its high smoke point and healthy fats.
- **Nutrient-Rich Food:** Eaten roasted, boiled, or as peanut butter, providing protein (more than meat/eggs), vitamins (E, B complex), minerals (calcium, iron, zinc), and antioxidants.
- **Malnutrition Treatment:** Peanut-based pastes (RUTF) are crucial for treating severe acute malnutrition in children.

Industrial & By-products

- **Oilcake:** Protein-rich residue used for livestock feed, enriched foods, and organic fertilizer.
- **Shells:** Used as fuel, filler, in particle boards, and for producing activated carbon.
- **Other Uses:** Oil is used in cosmetics, soaps, pharmaceuticals, paints, and even as a potential biofuel.

Global Significance

- Major global production by countries like China, India, Nigeria, and the USA.
- Significant portion used for oil extraction (around 50%), with the rest for direct consumption, confectionery, seed, and feed.

Commercial and Economic Significance

- **Global Trade and Export Revenue:** Groundnuts are a major cash crop in over 100 countries, with significant export markets in India, China, the USA, and Africa. India is a major exporter, with groundnut products, including oil and processed snacks, bringing in substantial foreign exchange. In 2022-2023, India exported 6.69 lakh metric tonnes of groundnuts, valued at Rs. 6,735 crores.
- **Value Addition and Processing:** Beyond raw nut sales, groundnut commercialization involves extensive processing, such as peanut butter, roasted salted nuts, blanched nuts, and groundnut flour. The edible groundnut market, particularly 'Hand Picked and Selected Groundnuts' (HPS), requires specialized sorting, driving employment in the processing sector.

- **Income Generation for Farmers:** Groundnut farming provides significant income to smallholder farmers, especially with improved, climate-resilient varieties that enhance market participation. Studies show that for every unit invested, groundnut production can offer high returns, with a B:C ratio sometimes as high as 1.6.
- **Industrial Applications:** The oil is used in manufacturing vanaspati, soap, cosmetics, and lubricants, while the residue (oil cake) is a valuable, high-protein component in the poultry and dairy feed industry.
- **Job Creation:** The entire value chain—from cultivation to oil extraction, processing, and marketing—supports millions of livelihoods.
- **Nutritional and Medicinal Value:** Groundnuts are valued for their high protein (25–30%) and oil (45–52%) content, as well as bioactive compounds like resveratrol and antioxidants, which boost their market value as a health-food product.
- **Soil Fertility Improvement:** As a leguminous crop, groundnut fixes atmospheric nitrogen, improving soil fertility for subsequent crops, reducing the need for synthetic fertilizers.

Key Challenges to Commercialization

Despite its potential, groundnut commercialization faces challenges such as, strict international standards for aflatoxin (a major non-tariff barrier, particularly in the EU), low productivity under rainfed conditions, and price volatility.

Soil

• Medium soils with very good drainage and loam soils are preferable. Heavy deep black cotton soils (clay) to be avoided.

• Lack of proper drainage adversely affects root growth ultimately affecting the crop. • In the absence of adequate oxygen in the root zone, beneficial soil bacteria, especially the nitrogen - fixers become ineffective and uptake of nitrogen by roots is hampered.

• The pegs can penetrate the soil easily and pods can be harvested from such soils with minimum losses • Adequate supply of calcium mineral in the soil is very essential for the production of groundnut pods . • Heavy and fine - textured soils with stiff clay cause difficulties in groundnut harvesting.

• Where groundnuts must be grown on heavier - textured soils, runner varieties of groundnut are more suitable than the Virginia types.

• High yields are obtained on soils with moderate acidic reaction (soil pH 6.0 to 6.4), alkaline soils being undesirable. Yellowing of groundnut leaves and blackening of parts of pods occur when the pH was 7.5 - 8.5. Soils having pH less than 5.0 are also not suitable for groundnut cultivation.

• The groundnut crop however, cannot stand frost for long and severe drought or water stagnation.

Climate Requirements

Groundnut thrives in tropical and subtropical climates between latitudes of 40°N and 40°S, and is cultivated up to about 1,065 m above mean sea level. The optimum temperature range for growth and flowering is 25–30°C. Temperatures below 13°C limit growth, while temperatures above 35°C reduce pollen viability. Soil temperatures below 18°C affect seed germination.

The crop requires bright sunlight; low light during flowering and pegging increases flower abortion and reduces pod formation. It is relatively drought-tolerant once established, though evenly distributed rainfall of 500–1,000 mm is ideal.

Varieties

Some of the recommended varieties are:

Andhra Pradesh: ICGS-11 (Bunch - Spanish); Kadiri 2, Kadiri 3, TMV-10, TG 1 (vikram) (Semi Spreading); Kadiri 71-1 (Spreading) TMV-2, JL-24, POLACHI, GG20, Gangapuri & Narayani.

Tamil Nadu: Spanish Improved, S-206, DH 3-30, KRG-1, DH-8, ICGS-11 (Bunch-Spanish); S-230 (Spreading).
Karnataka: ICGS-11, TMV-2, TMV-5, TMV-7, POL-1, TMV-9, POL-2, TMV-12, CO-1, CO-2 (Bunch- Spanish); TMV-11 (Bunch-Valencia); TMV-6, TMV-8, TMV-10 (Semi Spreading); TMV-1, TMV-3, TMV-4 (Spreading).
Maharastra : AK 12-24, SB XI, JL 24, TG 17, ICGS11 (Bunch - Spanish); Kopergaon (Bunch-Valencia); TG 1 (Vikram), Kopergaon 1, UF 70-103 (Semi Spreading); Karad, 11-Apr (Spreading), HD 11.
Orissa : Kisan, Jawan (Bunch - Spanish).
Madhya Pradesh: Jyoti, ICGS-11 (Bunch - Spanish); Gangapuri (Bunch- Valencia).
Gujarat : J 11, GAUG 1, GAUG 2, GG 2 (Bunch - Spanish); GAUG 10, GG 11, TMV-3, TMV-4 (Spreading), Ah 334.
Rajasthan: RSB 87s (Semi Spreading); RS 1 (Spreading).
Uttar Pradesh: T 28, T 64, Kaushal (G 201) (Semi Spreading); Chandra, Chitra (MA 10) (Spreading)
Haryana: MH 1 (Bunch - Spanish); MH 2 (Bunch- Valencia)
Punjab: SG 84(Bunch - Spanish); C 501, M 145, M 197 (Semi Spreading); PG 1, M 13, M 37, M 335 (Spreading), Punjab-1
Key Varieties for Bihar:

- **Mallika (ICHG 00440):** Recommended for Bihar and other states, known for good performance.
- **TG 22:** A specific variety released for cultivation in Bihar.
- **ICGS 1 (ICGV 87119):** Recommended for rainy season in Bihar and surrounding states.
- **TG 51:** A newer variety suitable for Rabi/Summer cultivation in Bihar and other Eastern states.

Key groundnut varieties include BG-1, a semi-spreading type suitable for the region, alongside widely adapted varieties like ICGS-11, JL-24, GG-2, and Trombay (TG) varieties (e.g., TG 1), offering resistance to diseases like collar rot and rust, with specific recommendations depending on whether it's a rainfed or irrigated crop and the season (Kharif/Summer).

Seed rate

Generally spreading and bunch varieties requires 90-120 kg/ha in Kharif, in rainfed situation. In Rabi, in irrigated conditions spreading varieties require 140-150 kg/ha.

Seed Treatment

Treat the seed with Mancozeb or Thiram 3 g/kg of the seed., Chlorpyriphose @ 250 ml / 45 kg of seed to prevent the seed damage from soil insects at initial stages.

Seed Inoculation

For incoculation 100 kg kernels of groundnut 800 ml jaggery (5% solution) and 200 g carrier based Bradyrhizobium culture (like NC- 92, IGR-6, IGR-40, TAL-1000 & TNAU - 14) is required. Seed are evenly spread over cement surface or polythene sheet and poured this slurry and gently smeared on the kernel surface. The treated seeds are then soon immediately.

Season and Sowing time

Groundnut is raised mostly as a rainfed Kharif crop, being sown from May to June. As an irrigated crop it is grown between January and March and between May and July.

Land Preparation

Optimum plant population of groundnut can be established with a seed bed having good tilth. After the harvest of the previous crop, soil is prepared by ploughing and harrowing several times before sowing of groundnut. Ploughing may be carried out after the receipt of premonsoon rains in May. The land is ploughed 2 to 3 times or more, followed by working

with blade - harrow twice. A soil preparation depth of 15 - 20 cm is generally considered for groundnut cultivation.

Plant Spacing

In rainfed condition, for the bunch varieties 30 x 10 cm • For the spreading varieties 30 x 15 cm • In Rabi, in irrigated conditions, for the bunch varieties 25 x 10 cm • For the spreading varieties 30 x 10 cm These plant spacings are easily accommodated on 1.2 m wide broad beds with 30 cm furrows on either side of the bed. Four rows of groundnut at 30 cm spacing is recommended per bed.

Earthing up

Earthing up in groundnut involves piling soil around the plant's base to support peg penetration and growth, helping with weed control and preventing pod exposure, but timing is crucial as earthing up during flowering can reduce yields by damaging delicate flowers (hypanthium) and preventing peg formation. While some studies show benefits like improved shelling and 100-pod weight, others suggest it's not always economical or necessary, especially with good management, and recommend light earthing up early or late in the season, avoiding the flowering stage. Provides a softer medium for pegs (which develop into pods) to grow into the soil. Covers and smothers weeds growing near the plant base. Covers exposed pegs and pods from pests (like birds) and sun damage. Helps prevent lodging (falling over) in some cases.

Crop Rotation

Groundnut in general should be rotated with cereals like maize, wheat, bajra, jowar or minor millets and tobacco.

Fertilizer Management

A general recommendation is 20–40–40–20 kg N–P_2O_5–K_2O–S per hectare along with farmyard manure. Entire fertilizer dose is applied in furrows before planting, ensuring seeds do not contact fertilizer directly. Application of phosphorus through single superphosphate helps meet sulfur needs. If SSP is not used, gypsum should be applied at about 250 kg per hectare around 20–25 days after sowing to supply calcium, which is essential for pod formation as calcium movement through the gynophore is limited.

Micronutrient Management

Acidic soils limit availability of boron and molybdenum. Boron deficiency leads to pollen abortion, hollow-heart formation, and poor gynophore development. Soil application of borax or foliar sprays correct deficiencies. Molybdenum deficiency reduces nitrogen fixation and can be corrected by treating seeds with ammonium molybdate. Zinc deficiency, common in sandy soils, is corrected through soil application of zinc sulfate or foliar sprays.

Weed management in groundnut

Effective weed management in groundnut uses an Integrated Approach (IWM) combining cultural (mulching, crop rotation, hand weeding during critical stages like 25-45 DAS) and chemical methods (pre-emergence like Pendimethalin, or post-emergence like Imazethapyr mixtures) to control weeds that compete heavily for nutrients, water, and sunlight, especially during groundnut's slow initial growth. Combining pre-emergence herbicides with a timely hand weeding is often most effective, while specific post-emergence herbicides control late-emerging weeds.

Irrigation of Groundnut

Groundnut is very sensitive to salinity of soil and irrigation water quality. • The irrigation water for groundnut should have EC less than 4.0 mmhos/cm . • Vigorous flowering is the period of greatest sensitivity to moisture stress which is 6-8 weeks after seeding. • The pegs cannot enter the soil if the soil surface is hard due to prolonged dry-spell. • Flowering, peg penetration and early pod formation are the moisture sensitive phases of groundnut growth.

Sprinkler Irrigation • Sprinkler irrigation is generally adopted for groundnut considering the crop height and the nature of fruiting. • The costs are also low for sprinkler compared to drip. We recommend Rainport Minisprinkler and Rainport 5022-U Impact Sprinkler system for Groundnut. • The irrigation quantum (mm) is decided after studying the soil texture and its infiltration capacity. • Application rate per irrigation should be equivalent to the infiltration rate of the soil of each location approximately this would be 15-20 mm at a time for the soil types mentioned above.

Plant Protection

Major Pests: White grubs and termites can be controlled through seed treatment, soil application, and drenching with chlorpyrifos or other recommended insecticides. Hairy caterpillars are managed through light traps and insecticidal sprays. Leaf caterpillars, thrips, and leaf miners are controlled using pheromone traps, biological agents, or specific insecticides.

Major Diseases: Tikka disease caused by *Cercospora* species is managed through resistant varieties, seed treatment, and periodic fungicide sprays. Collar rot caused by *Aspergillus niger* results in basal stem rot and can be controlled through seed treatment, soil drenching, and regulated irrigation. Bud necrosis, a virus disease transmitted by thrips, is managed through vector control and tolerant varieties like Kadiri-3 and AK-12-24.

Post-Harvest Management

Harvesting, Curing, and Storage: Timely harvesting is crucial for high pod and oil yields. Signs of maturity include yellowing leaves, shedding of older leaves, appropriate testa colour, and darkening inside the shell. After lifting, plants are kept in small stacks for a few days for curing before pods are separated. Pods should be dried to about 5% moisture to avoid aflatoxin contamination. Under good management, bunch types yield about 1.5–2.0 t/ha, while spreading types may yield 2–3 t/ha. Stored pods should be kept in well-ventilated storage rooms, preferably on wooden platforms.

Conclusion

Groundnut is a cash crop which provides farmers with income and livelihoods. It also contributes to farm families' well being through eating energy- and protein-rich groundnut kernels and provides livestock with nutritious fodder. Groundnut farming thus leads to the survival of mixed crop-livestock processing systems, the most widespread semi-arid system in the world. Groundnut (*Arachis hypogaea* L.) serves as a critical commercial oilseed and food crop, acting as a major income generator for farmers and a key source of foreign exchange for producing nations. Its economic significance in commercialization stems from its high oil and protein content, widespread industrial processing into value-added products, and its role as a key component in global trade. In last, groundnut cultivation is not merely farming; it is a vital, integrated industry that drives economic growth through both domestic consumption and international trade while supporting sustainable agricultural practices.