PACKAGE OF PRACTICES FOR GROUNDNUT CROP

R.B. Singandhupe, R.R. Sethi, B.K. James, H. Chakrabarty, Ashwani Kumar

Water Technology Centre for Eastern Region
(Indian Council of Agricultural Research)
Chandrasekhpur, Bhubaneswar - 751023, Orissa
Introduction
Groundnut is one of the most important oilseed crops of India. Among all oilseed crops groundnut has occupied first place in India as it can withstand drought and is quite suitable for dry land farming. It is soil erosion resistant crop and being a legume it can fix atmospheric nitrogen with the help of nodule bacteria and improve soil fertility. It provides green manure for succeeding crop. Its shell, skin, haulm and hay are good fodders. It is an important cash crop, useful as rotational crop. It is an excellent money earner and chief source of protein. The chemical constituents present in groundnut kernel are: water 3.2 to 13%, protein 21.4 to 36.4 %, fat 35.5 to 54.2 %, total carbohydrate 6 to 24.9 %, starch 0.9 to 5.3 % and ash 1.8 to 3.1%. These ingredients are very useful for daily human diets.

In India groundnut occupies 28 % (5.95 M ha) of the total area of oilseed crops (21.22 m ha, 2002-03). This crop is mainly grown in the states of Gujrat (34.1 %), Andhra Pradesh (24.71 %), Karnataka (14.12 %), Tamil Nadu (9.24 %), and very less area in Orissa (1.04 %). In Orissa, it is cultivated in both kharif and rabi/summer season, but here the productivity is very low as compared to other major groundnut growing states. During rainy season, it is grown in upland condition without irrigation and during rabi and summer seasons it is grown after harvest of kharif rice wherever irrigation facility is available. The productivity of irrigated groundnut is also quite low as compared to that of other states due to lack of appropriate cultivation practices. The following package of practices for groundnut crop can boost the groundnut productivity in this state.

Use of good seed
Use of good seed is the foundation of higher yield. The chief characteristic of a good seed are purity, viability and uniform size and free from insect and fungal damages. The pod should be shelled not more than two-weeks in advance of the sowing time. Treatment with fungicides like thiram/ captan / Bavistan can control soil and air borne diseases.

Plant stand
Inadequate plant stand has been identified as one of the critical factors limiting groundnut yield. The main reasons of poor plant stand are inadequate preparation of land, use of un healthy and sterile seed, non-treatment of seed, and non-adoption of optimum seed rate. For better plant stands, soil should be prepared with good seedbed, free of weeds. A seedbed with good tilth is essential for proper germination of seed and establishment of plant stand. Ploughing up to 20-30 cm depth helps in increasing pod yield owing to increased water uptake and root penetration activity.

Crop spacing
The seed should be placed in a furrow at a depth of 5-7 cm under optimum soil moisture condition with the spacing of 30 cm row to row and 10 cm plant to plant. Pre-sowing heavy irrigation is important for uniform germination of seed. In case, good amount of soil moisture is available after harvest of kharif rice crop, then it is desirable to sow the seeds on residual soil moisture and apply irrigation after complete germination of seeds. Line sowing with power driven or bullock drawn seed drill is the best method of sowing. The seed rate (with pod) should be around 55-60 kg/acre.

Selection of varieties
A number of improved varieties have been released at national and state level. Runner and bunch type of varieties produce larger fruits and possess higher yield potential. In this region, AK12-24, JL24, Smruni, TMV2, ICGS 11, GG 2 have been found performing satisfactorily.

Fertilizer application
Groundnut is energy-rich crop. But it is grown under energy-starved conditions. An average crop of groundnut removes about 112 kg N, 27 kg P₂O₅ and 34 kg K₂O from 1 ha of land. So for proper growth of plant, supply of adequate amount of major plant nutrients i.e. nitrogen, phosphorus and potassium are important. Similarly some micronutrients have responded significantly in micronutrient-deficient area. So fertilizer application with optimum level is important component of production technology for higher pod yield. Groundnut being a leguminous crop, is capable of converting atmospheric nitrogen into nitrate and thereby adding nitrogen to the soil. Thus groundnut does not require application of liberal dose of nitrogen fertilizer. Under optimum condition, groundnut can fix 180-200 kg of nitrogen per ha but the extent of nitrogen fixation in soil depends on genotype of host plant, rhizobial strains and other external factors like moisture stress, soil temperature, availability of nitrogen, phosphorus, manganese, magnesium, calcium, molybdenum, iron, zinc, and boron. As the bacterial nodules do not develop on roots until about the plants are 15-20 days old, an initial application of 10 kg of nitrogen per ha is necessary. Depending upon the number and effectiveness of root nodules, a top-dressing of another 10 kg nitrogen/ha may be provided at 30 days after sowing.
Phosphorus is important an element for proper root development, it is essential in leguminous crop in early stage of development because of formation of bacterial nodules on the roots. So on the basis of soil test it would be best to apply phosphorus in the form of single super phosphate so that calcium(19.5 %) and sulphur(12.5 %) can be supplemented for higher yield of groundnut. Application of 40 kg of \( P_2O_5 \) ha (250 kg single super phosphate) at the time of sowing is recommended for groundnut crop. Indian soils are generally rich in potassium but 40 kg of \( K_2O \) ha in the form of muriate of potash (66.7 kg ha) is generally recommended at the time of sowing. In low available potash contains soil, application of potassium, maintain proper balance of \( K : Ca : Mg \) ratio as any imbalance of these nutrients affect pod yield.

Other fertilizer

Groundnut being a leguminous crop, calcium and sulphur plays important role in crop production. Calcium deficiency in groundnut increases unfilled pods and reduces pod development. Sulphur is directly involved in biosynthesis of oils. Since these elements are relatively immobile and not translocated in sufficient quantities right from root to the seed of developing pods, these have to be made in sufficient quantities in the pod zone area. So to meet the demand of these elements gypsum can be applied @ 250 kg/ha in two equal splits at sowing and pegging period. Good quality gypsum contains 23 % calcium and 18 % sulphur. Based on soil reactions (soil pH), ammonium sulphate may also be used in groundnut crops.

Biofertilizer

Biological nitrogen fixation through micro organisms as biofertilizers comes to the rescue of the farmer as a cheap and supplementary source of nitrogen. This can be achieved by artificially inoculating pre selected effective and efficient Rhizobium. In general, 200 g of carrier based Rhizobium inoculum is recommended per hectare. Application of rhizobium inoculum below seeds either in liquid form or with sand using methyl cellulose as sticker helps to avoid the harmful effect of fungicides used for seed treatment. In rice-groundnut cropping system, inoculation of seed or soil with rhizobium is important in irrigated groundnut. In rice fallow system, annual application of rhizobium is necessary since the bacterium does not thrive under the anaerobic condition when the crop is grown under submergence.

Seed Inoculation

A solution of 5% jaggery or sugar is prepared in water. 800ml solution is necessary for treating 100 kg kernels of groundnut. Two hundred grams of carrier based Rhizobium culture is added to the cold slurry.

1. Seeds are evenly spread on a cement floor/polythene sheets and slurry is poured and evenly smeared on the kernel surface. For uniform application of the inoculum small batches of seed may be treated.

2. The treated seeds are dried in the shade to avoid mortality of the Rhizobium. The seeds are then sown immediately.

3. Most of the seed-treating fungicides used to prevent seed-borne diseases also kill the inoculant rhizobium.

4. Seed inoculation and seed treatment with fungicides, therefore, tend to be mutually exclusive.

When both are essential, the seed may be treated first with fungicide and the Rhizobium culture is subsequently applied in the soil by liquid inoculation/ granular inoculation/ rhizobium mixed in compost.

Irrigation

Groundnut is cultivated with irrigation both in kharif usually rabi/summer seasons. In kharif season irrigation is provided as a protective measures while during rabi/summer seasons crop is totally supported by irrigation. Adequate moisture is important at sowing, flowering and fruiting stage of crop growth. Seed should be placed in moist seedbed and for this purpose heavy pre-sowing irrigation is essential. Immediately after pre-sowing when soil comes to optimum moisture level, the ploughing should be followed and line sowing should be done at appropriate spacing (30 cm x 10 cm). In rabi season when sufficient residual moisture is available then the seed is to be sown in a well pulverized soil without irrigation. Two or three weeks after sowing, light irrigation followed by intercultural operation could be done. Subsequent irrigation may be given as and when required depending upon the variety, soil and seasonal condition. As the crop begins to mature, the frequency of irrigation is to be reduced. In case of rabi and summer groundnut the number of irrigation ranges from 6 to 9.
Weed control
The groundnut field should be kept weed free up to 45 days after sowing. Thereafter, disturbance of the plant has to be avoided so as not to damage the process of peg entering in to the soil. First inter-culture operation is required at the time of flowering i.e. three weeks after germination and second inter-culture operation should be carried out after another 3-4 weeks. In case of semi-spreading variety it is essential to earthen-up the soil around the plant at the time of inter-culture that enables the pegs to reach the soil and form the pods.

Plant Protection
Groundnut crop is prone to attack by numerous diseases to a much larger extent than many other crops. More than 55 pathogens including viruses have been reported to affect groundnut. Among fungal foliar diseases, only a few are economically important in India such as leaf spots (early and late) and rust which are widely distributed and cause losses in susceptible genotypes to the extent of 70 per cent when both of them occur together.

The seed and soil-borne diseases viz. collar rot, stem rot and dry root rot have been realized as major limitations of groundnut crop yield. These diseases cause severe seedling mortality resulting in 'patchy' crop stand in sandy loam soils and reduce the yields from 25-40 percent. Some of the important diseases and their remedies have been given below: leaf spot (tikka: Cercospora personata) and rust.

Symptoms: Dark brown circular spots appear on the lower surface of the leaves with necrotic lesions appearing on both the surface of leaf. Spots occur on petioles and stem also. In severe cases, the spot enlarges and leaves become yellow. In both diseases, spraying of Bastivin (0.05%) plus Diathane M-45 (0.2%) two to three times at 2-3 weeks interval starting about a month after sowing can control the diseases. Spray application of Tridermoph 2 g/litre at 14-21 days interval 3-4 times after initiation of infestation can control rust disease.

Root Rot (Rhizoctonia bataticola), local name: Chera sadha roga: The affected seedlings wilt and die. Many infested seeds fail to germinate.

Stem Rot (Macrophomina phaseoli) local name: Kanda pacha roga: Watersoaked spot appears on the stem at ground level. Mustard like fruiting bodies are formed on the affected portion of the stem. Subsequently the plant withers and dies.

Collar Rot (Sclerotium rolfsii), local name: Sadha roga: It occurs in January-February months. The fungus affects the plant just above the ground level, black-rotting patches develops at the base of plant initially. The affected plant wither and die.

Control measures
i) For controlling these diseases, seed treatment with thiram / captan / captan / carbofuran at 2.5 to 3 g/kg kernel is to be followed.

ii) Over irrigation of plot during seedling stages should be restricted.

iii) Drench basal portion of plant with thiram @ 1 g per litre of water or mixture of tetrachlor @ 20 kg/ha plus terrazole @ 40 kg/ha at pegging is needed.

Insect and Pest
Important insect and pest of groundnut are aphid, jassids, white grubs, red hairy caterpillar, leaf miner and termites.

Termites (Odontotermes obesus, local name: Uei) and White grubs (Hachinortex consanguinea, local name: Dhabala bhrunga sabak). It occurs from June to July (in kharif groundnut) and January to February (in rabi groundnut). The termites attack the underground part of the plant such as roots, pods and stems as a result of which plant wither and die. For controlling beetles, termites, and white grubs seed treatment with Chlorpyriphos 20 EC at 2.5 ml per kg of seed gives good
result. Spraying of Carbaryl 50 WP or Sevin is enough to control the pest. In areas where it is severe, application of 25 kg/ha of thimate granules to soil before sowing results in effective control but it is cost effective. The following pictures are the damaged plant of different pests.

Aphids  
Jassid  
Termites  
Leaf minor

For leaf minor, spraying of solution of monocrotophos, dimethoate and carbaryl @ 2 ml per litre have been found most effective.

**Intercropping of groundnut**

Intercropping system involves growing together two or more crop species with the assumption that two crop species could exploit the environment better than one. Intercropping system is designed in such a way that in case of unfavorable weather or outbreak of pest and diseases at least one crop will survive to earn economic yield. Groundnut is a short stature crop is usually intercropped with long stature "arhar" in appropriate ratio in upland situation to give good return. In case of intercropping with arhar, 4:1 or 6:1 ratio of groundnut : arhar is followed. The arhar crop being a deep-rooted extracts soil moisture from deeper zone and groundnut extracts soil moisture from shallow depth. Thus, both the crops can survive comfortably under prolonged dry spell condition during rainy season and sustainable produce can be obtained. The intercrop of groundnut can be followed with many long stature cereal crops also.

**Harvest**

Harvesting of groundnut crop should be done when it is fully mature as it is seen from the yellowing of the vines and shedding of leaves. Usually harvesting of groundnut is accomplished with help of country plough or blade harrow by digging the soil and pulling out the plants. The pods are then separated from vines after a week. The groundnut pod should be dried to a moisture level of not more than 9% as storing of wet produce results in development of rancidity and also favors growth of fungus *Aspergillus flavus*, which produces toxic substances in the nut. It is desirable to store groundnut in the form of pods than kernel in gunny bags. The bag should be inspected periodically so that timely steps are taken against storage pest.

**Post harvest operation**

After harvest of groundnut crop, curing, drying and storage are important operations, which have a vital bearing on the viability of seed for next season's sowing and on the quality of oil. By curing moisture is removed from the groundnut halm in and in drying from groundnut pods after they are separated from the hualms. In the presence of high moisture in pod and kernel the aflatoxin which is developed by the particular strains of mould *Aspergillus flavus* deteriorates the quality of ground nut and makes unsuitable for seeds as well as edible items. This *Aspergillus flavus* grows on substrate with high moisture content at tropical temperature (about 30°C) but it is unable to grow below 80% relative humidity. To avoid any mould growth, the moisture content in kernel should be about 9% and in unshelled nut it should be about 11.5%. If the unshelled groundnut is properly dried then the produce is free from aflatoxins.
For farmers practical point of view the simplest and the most common method of curing and drying practiced by the farmers is to spread the plants on the ground with foliage bent downwards and stack the plants in a heap of pyramidal form with nuts exposed to sun. The heaps are kept in this position for varying period of time. The pods are then separated from the husk mostly by hand and the nuts are then spread out on the threshing yard.

**Successful groundnut production by ground water use in Coastal tract of Orissa**

Ground water development of Orissa state is very low (14.79%). In coastal belt of Orissa, ground water is available in ample amount and even at very shallow depth, but its utilization is not up to satisfactory level due to several constraints. After preliminary survey in distributory no.5 of Pattnamai Canal (Mahanadi Delta I) on availability of ground water, canal water supply, fluctuations of ground water table, the efforts were made to use ground water during winter and summer season for growing two to three crops in a year and increase cropping intensity by more than 200%. Before intervention of our technology on ground water exploitations in crop production, the farmers were growing rice during kharif season and moong / urd during rabi season on residual soil moisture and harvesting very low yield of moong/urd crops. During 2004-05, after harvest of rice crop, groundnut varieties AK 12-24 and JL24 were grown in 11.45 acres of area by involving 23 farmers on participatory mode. They irrigated groundnut crops through tube well water. On an average, irrespective of different amount of irrigation water applied by the farmers, the pod yield of groundnut AK 12-24 was 1.74 t/ha and JL 24, 2.03 t/ha. The variety JL 24 was comparatively better than AK 12-24. Rice followed by groundnut produced net profit of Rs.28208/ ha in rice groundnut cropping system. Some of the farmers applied more number of irrigations in groundnut; and obtained higher net return (upto Rs 31,317/- per ha in case of four irrigations and Rs 39,742/- per ha in case of five irrigations) in rice-groundnut-cropping systems. Even after harvest of rabi groundnut there was enough time to take up short duration third crops through ground water use and increase cropping intensity further.

During 2004-05 Water Technology Centre for Eastern Region (ICAR), Bhubaneswar supplied seed and fertilizer without any return from the farmers as incentives to initiate our technology on ground water use. But during 2005-06, after harvest of kharif rice, about 54 farmers have taken rabi groundnut variety TMV 2 in 19 acres of land on participatory mode. During this year all farmers have borne the cost of both seeds and fertilizers and also registered the groundnut crop with seed certification agency, Government of Orissa. The produce obtained by the farmers will be handed over to the government department after fulfilling the quality criteria of certified seed. In such seed production technology the farmers can get more return than the local market price of their produce. The certified seeds will be used by the farmers in ensuing kharif season as Orissa state shows the deficit for groundnut seed every year.

**Constraints**

In this area, there is possibility of taking third crop after harvest of rabi season crops but due to absence of standing crops in surrounding area and no proper protection from stray cattle / animal, the farmers are reluctant to grow short duration third crops. For increasing 300 % cropping intensity in this command area, it is urgent need to form a group/ association and grow the crops in large area by using ground water.

**Suggestions**

Since the canal water supply is not enough for rabi crops, it is highly imperative to use ground water which is available in ample amount throughout the year. The farmers in this area are having small land holdings; they are unable to develop ground water structure individually due to higher investment for creation of ground water structures. It is therefore, suggested to form a group based on land holdings; develop ground water structures and share the water for growing rabi and summer crops. If such type of association or group is created among the farmers, then ground water resources will be fully utilized and the waterlogging situation occurred during kharif season due to excess rain and canal water will be minimized.

**Published by:**

Dr. Ashwani Kumar, Director, Water Technology Centre for Eastern Region, Bhubaneswar - 751023