foreign assets for want of sufficient surplus, and there is a world shortage of edible oils. The Panel on Oils and Soaps have recommended an increased production of about 2 million tons of nuts in shell. To save a serious situation we have to increase our exportable surplus of groundnut urgently, and also for the ever-increasing internal consumption. This has to be brought about by every possible means at our command. It is not quite practicable to increase the area under the crop but it can be introduced into the rotation of crops with cereals, pulses and cotton. In single-crop wet lands it can be grown after a first crop of rice in large areas of the State where facilities exist. The high-yielding, improved strains of groundnut now available have to be multiplied on a large scale and distributed among farmers so as to replace the less paying local forms. An efficient organisation to carry on this line of work is required.

Evolution of strains suitable for the large groundnut tract of the Andhra districts is an urgent necessity. Research on every aspect of groundnut production has to be intensified under a whole-time Specialist with sufficient staff, and facilities on a regional basis. Money invested on groundnut research is sure to be fruitful and benefit the country in no small measure.

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# Maximising the production of Gingelly in Madras

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**Introduction:** Gingelly (*Til*) or Sesame (*Sesamum indicum* Linn.) is one of the oldest of oilseed crops of the tropical and sub-tropical countries of the world. According to Hildebrandt, the plant is supposed to have originated in Southern and South-Western Africa. However, considering the large diversity of forms met with under cultivation, India and Japan are recognised as important secondary centres of origin. In India the plant has been under cultivation as an oilseed from time immemorial.

The sesamum plant is cultivated for its seeds which contain about 50 per cent by weight of an edible oil of excellent quality. The oil is largely in demand for culinary purposes, especially in South India and to a lesser extent for soap making. Many medicinal properties are also attributed to the oil. In fact it is the base for the preparation of a variety of medicated oils in Ayurveda. An impressive list of medicinal uses attributed to the different parts of the plant in India and elsewhere has been given by Kirtikar and Basu in their "Indian Medicinal Plants". In America and Europe, gingelly oil is reported to be utilised in the manufacture

of oleomargarine, shortenings, cooking oils, soaps, paints and drugs. One of its important new uses is as a carrier of the wonder drug penicillin. Sesamin, a constituent of the oil has been definitely established to have the property of enhancing the insecticidal potency of pyrethrum.

The whole seeds are also nutritious. It has a calorific value of 564 and a vitamin A content of 107 international units, per 100 gm., and is considered a rich source of calcium and iron. The seeds from a common ingredient in many kinds of sweets and confectionary preparations.

The residual cake or meal left after the expression of oil is a concentrated feed for milch cattle. The cake contains about 6 per cent nitrogen and can also be used for manurial purposes. However, the entire quantity produced in India, estimated at 1,300,000 tons is utilised at present as cattle food and no quantity appears to be diverted for manuring crops. Moreover, the production is insufficient even to meet the demand for feeding cattle. Cake from polished seeds is used for culinary purpose in the Circars.

**Area and Production:** The annual world production of gingelly seeds is estimated at 2 million tons, 80 per cent. of which is accounted for by India and China. The Indian Union with an annual production of about 3 8 lakhs of tons is second only to China which ranks first with 4.6 lakhs of tons. In India the crop occupies nearly 4 million acres i.e., about 16 per cent. of the area devoted to oilseed crops, and ranks third in importance among the principal oilseed crops grown in the country. Uttar Pradesh leads the other States accounting for as much as 33·6 per cent. of the area and 31·6 per cent. of the production of India. The Madras State comes next with 17 7 per cent. of the area and 20 7 per cent. of the production. Her annual out-put is estimated to be about 80,000 tons from roughly 7 lakhs of acres. The area devoted to the crop works out to nearly 13 per cent of the total area under oilseeds in the State. The Circars comprising the districts of Visakhapatnam, East and West Godavari, Krishna and Guntur, account for over 50 percent. of the gingelly area in the State. The district of Visakhapatnam alone posseses over 1·3 lakhs of acres.

**Utilisation:** Prior to World War I, India was an exporter of gingelly seeds to the tune of about 1 lakh of tons per annum. In recent years the export has dwindled considerably; during the period 1946 to 1948 the quantity exported averaged only about 1,000 tons per annum. The consumption in the country has gone up but the production has not correspondingly increased with the demand. The net result is that not only is there no surplus left over for export, but there is even a widespread shortage of the commodity in the country.

Out of the total production of about 3·8 lakhs of tons of seeds in the Indian Union, 3 lakhs of tons are estimated to be crushed, yielding about 1 2 lakhs tons of oil. Out of this 7,500 tons are reported to be used for Vanaspathi manufacture, 80,000 tons for edible and 20,000 tons for hair-oil and other non-edible, domestic purposes.

**The Present Position in Madras:** Gingelly oil is the principal oil used for culinary purposes in the Madras State with the exception of Malabar and South Kanara districts where coconut oil is preferred. The oil is also used in appreciable quantities for anointing the hair and body while taking an oil bath, a custom which is prevalent among the people of South India. In recent years

there has been a steep rise in the price of this oil in the Madras State. The index number of the price prevailing towards the end of April 1950 ranged from 390 to 674. The high cost has placed gingelly oil out of the reach of the lower strata of population, who have naturally been forced to take to relatively cheaper oils like groundnut oil.

Even in normal times gingelly is in short supply in the Madras State and quantities averaging a little over 25 000 tons of seed i. e., 30 per cent of the production is annually being imported into the State from Orissa, Hyderabad and Uttar Pradesh. There is very little export of gingelly seeds from Madras and therefore the entire quantity produced in the State and that imported from outside, totalling to a little over a lakh of tons is consumed in the State itself. Consumption is mostly in the form of oil, as 90% of the net available quantity is utilised for crushing. There is no import of gingelly oil into the State from outside. Therefore the present quantity of oil consumed annually in the State can be taken to be somewhere about 40,000 tons. This falls considerably short of the State's requirements as will be clear from the succeeding paragraphs. It is therefore very necessary that attempts should be made early to step up internal production.

Target of Production to be aimed at. Before dealing with the measures that are to be taken to increase production, it is necessary to have a general idea of the States' requirements. In the absence of reliable data this is obviously a difficult task. Moreover, there are two ways of approaching it. Are the plans to be drawn up with an eye to the future or are they to be drawn up with reference to immediate needs? The rational approach will be to draw up an integrated plan which will include both short-term and long-term measures, that will fit in properly with each other.

Since gingelly oil is largely consumed only for culinary purposes, our aim for the present needs take into consideration only its requirements for edible and anointing purposes Any surplus left over alone should be allowed to be diverted for industrial uses. The Nutrition Advisory Committee has recommended 2 oz. of fat or oil as the minimum per capita, per day consumption. Though this level of fat consumption should be our ultimate goal, it may well be considered as ambitious in view of the present economic conditions prevailing in the country. However,as the standard of living of the people improves, and people become more and more nutrition conscious, the consumption of fats among the population is bound to go up. Provided unadulterated gingelly oil is made available in adequate quantities and at a cheaper price, there is every reason to expect an ever-increasing popularity for the oil, resulting in increased demand. It is not suggested that gingelly oil is the only form in which fat is consumed in the country. In the higher income groups ghee might be the chief source of fats, while those in the lower income groups might go in for cheaper oils like groundnut oil, niger seed oil, safflower seed oil, etc. Vanaspathi or hardened vegetable oil may also to some extent satisfy the requirements of fats.

Considering all the above factors, it may not be out of place if we aim at a per capita per day, requirement of 1 oz. of gingelly oil. Even assuming that only 30 out of the 50 millions of Madras State are habitual users of gingelly oil or will take to it if the supply position improves, the State's annual requirements of oil can be reckoned at 3 lakhs of tons as against the present consumption of nearly 40,000 tons. The extent of leeway to be made up can very well be imagined if we have to attain eventual self-sufficiency in regard to gingelly oil. To get this quantity of oil nearly 8 lakhs of tons of gingelly seeds have to be utilised for crushing. Taking into consideration the quantity of gingelly seeds consumed as such and also the quantity that has to be reserved for seed purposes, the target of production in the State to be aimed at is nearly one million tons. It may well be that these figures are exaggerated and wide of the mark. They have been referred to here only with a view to emphasizing the fact that the requirements of gingelly seeds in

the State in future are likely to be considerable, provided all the factors for the increased consumption of fats are favourable. It is also not suggested that the high target can ever be achieved in the State. Even the Panel on Oils and Soaps constituted by the Government of India has recommended only an increased production of 6 lakhs tons for the whole of India. There is, however, no doubt that the present position admits of considerable improvement.

The Scope of Increasing Production. The foregoing paragraps would show the urgent necessity to increase the internal production. The next step is to examine the various measures that will help to step up the production. The ways open to us are either to increase the area under the crop or to increase the yield per acre or both.

**Increasing the area:** Increasing the acreage devoted to the crop in the State will naturally be the step which will suggest itself first. The present indications are that, though possibilities exist in this direction, they are not capable of being exploited for the purpose with any degree of confidence. A perusal of the figures for the area under the crop in the State for the past 15 years shows that though the area fluctuates considerably from year to year, the trend is definitely downward. During this period there has been a decrease in acreage by about 3 per cent, but the more disquieting factor is that the production has gone down by as much as 15 per cent. This is not surprising in view of the fact that out of the total estimated normal area of 7 lakhs of acres in the State, only one lakh of acres is raised under irrigated conditions which gives a sure crop. The remaining area is raised under entirely unirrigated and rainfed conditions. The area sown to the crop depends considerably on the receipt of rains at the proper time for sowing and the yield is influenced by the climatic conditions prevailing during crop growth and the incidence of pests and diseases The crop being a delicate one, it easily succumbs to any adverse conditions. The seasonal conditions have in fact been generally unfavourable for the crop throughout the State for a number of years. The seasonal factor has not been quite normal during the past 15 years, being 80 to 90 on a number of occasions. The fall in production is therefore only to be expected.

A limited increase in area is possible by adopting the following measures. The crop can be introduced in single-crop wetlands after the first crop of paddy. This method of cropping is already in vogue in certain districts, particularly in Visakhapatnam and may well be introduced where conditions are favourable and admit of such a practice. The extent of area that could possibly be brought under this system of cropping can be ascertained only after a detailed survey of the different districts. With the expansion in the irrigated area that is bound to follow when the various irrigation schemes in the State are completed it should be possible to increase the area under the gingelly crop also. There is also a possibility of taking a short duration gingelly crop after the harvest of the main crop of groundnut or cereal raised in drylands during the rainfed season. This practice is very common in the red loamy soils of South Arcot district and can with advantage be extended to most of the other Central and Southern districts of the State. Nearly one lakh of acres can be brought under this system of cropping, provided conditions are favourable, and seeds of suitable varieties are made available in sufficient quantities and in time. The area actually sown and the yield obtained will however depend to a large extent on the receipt of adequate and timely rains during the North-East monsoon period and one or two showers in January–February. The precaution suggested in regard to the choice of suitable varieties is very necessary as gingelly is a season-bound crop and all varieties are not capable of coming up well in all seasons. A gingelly strain suited for cropping during the cold weather has recently been evolved at the Ground nut Research Station, Tindivanam. This should facilitate the popularisation of this system of cropping among the ryots.

The introduction of gingelly as a mixture crop in the drylands on a wider scale than is being done at present will also help to increase the area under the crop. This practice is very extensive in Uttar Pradesh and may be followed in this State also.

**Increasing the Yield per Acre.** It has been shown that though possibilities of increasing production by extending the area under the crop exist, they are rather uncertain as long as the crop is under rainfed conditions. A better and perhaps a surer approach to the problem will be to increase the yield per acre. In this direction the possibilities are immense, though much time, effort and money may have to be expended to reap the maximum benefit. The average yield per acre of gingelly in the State as per the Season and Crop Reports is about 300 lb. This does not appear to have been based on the results of any systematic crop-cutting experiments, and in reality appears to be fixed a little too high. Extensive study of the practices followed by the ryots at present has revealed a number of defects. The improvements suggested below will help to increase the yield per acre.

1. **Prepare a good seed bed:** To ensure proper field germination, the soil should be worked to a fine tilth and care should be taken to see that adequate moisture is available in the soil at the time of sowing. These are not being done now.

2. **Sow a variety adapted to the environment:** Gingelly is a season and tract-bound crop and varieties behave differently according to tracts and seasons. Thus many varieties are met with under cultivation in the different parts of the State Most of the ryots out of long years of experience, know exactly what varieties to sow under particular conditions. However, when cultivation is taken up in new localities, sufficient care has to be bestowed in choosing a suitable variety for cultivation.

3. **Use good seeds:** Seeds having good germination percentage alone should be used for sowing. The stand of plants depends a good deal upon the viability of seeds. This precaution is particularly necessary in the case of gingelly seed which is extremely susceptible to severe insect attack in storage. Viability is poor in insect damaged seeds.

4. **Provide adequate stand:** Optimum stand of plants per unit area is necessary to obtain maximum yields. When more number of plants than this limit is allowed to grow there is competition among the plants for the available plant-food with the result that the yield gets reduced. When the plants are few, growth is usually more vigorous but the yield per plant is not adequate to compensate for the fewer number of plants. The optimum number may vary with the variety, the conditions under which the crop is grown, the fertility status of the soil etc and has to be fixed with reference to the conditions prevailing.

Poor stands of crops is a common feature in the cultivators' fields and gingelly is no exception. The poor stand may be due to a variety of causes such as using low seed rate, poor germination arising out of the bad quality of the seed, want of proper tilth and moisture in the soil and incidence of pests and diseases. Instances where the plants are too crowded are also equally common. This arises out of the fact that the ryots use a higher seed rate than is actually necessary in order to safeguard against likely unfavourable conditions but do not care to thin out the plants later on when the conditions are favourable. Thinning in such cases is essential in order to induce better branching and setting of capsules. Educating the ryot in this line is sure to bring good dividends.

**Manure properly:** Gingelly crop is an exhaustive crop and naturally will have to be provided with adequate plant food if satisfactory yields are to be obtained. At present the crop is seldom directly manured, it being left to grow with the residual effect of the manures applied to the preceding crop. Adequate and direct manuring may help to increase the yields.

**Attend to regular weeding:** Ryots seldom do any systematic weeding of the crop. Weed competition especially in the initial stages, affects the growth and yield of plants. A hoeing and weeding between the 20th and the 30th day after sowing has been found to be very necessary and beneficial. The ryots may well pay more attention to this aspect and they will be benefited.

**Control pests and diseases:** The gingelly crop in the State in subject to the attack of some destructive pests and diseases The most important insect pest of gingelly crop in the field is the shoot-webber (*Antigastra catalaunalis*). The pest assumes serious proportions in periods of drought and often devastates the entire crop. Where the infestation is mild, application of calcium arsenate and lime (1:6) has sometimes given good results.

Among the diseases, the most serious is the "little leaf disease" or Phyllody. The disease is characterised by the proliferation of reproductive parts into vegetative structures. This is prevalent in most of the gingelly tracts in the State The disease has been observed to occur in a more virulent form in the irrigated crop and no yield can be expected in such cases. The causative factor for the disease, the nature of its spread and measures to be taken against it are all practically unknown and merit investigation without delay. For the present, removal and burning of the plants showing early symptoms of the disease is recommended as a control measure.

**Gingelly Research in Madras:** The improvement work of gingelly in Madras was initiated only in 1931, with the establishment of a separate section under an Oilseeds Specialist to deal with the principal oilseed crops of the State. The work is being done at the Groundnut Research Station, Tindivanam along with that on groundnut and castor. The staff and facilities being meagre and greater attention having to be paid to groundnut, work on gingelly had perforce to be restricted to the evolution of improved strains only. The vast field of cultural, manurial and pests and diseases investigations is practically untouched. Inspite of such handicaps some results of practical utility to the ryots have been achieved. They are, in brief, the following:

1. **Evolution of high-yielding strains:** As a result of intensive selection and hybridisation work, three strains with high yield and good quality of produce have been evolved. Strain T. M V. 1 has been found suitable for growing during the rainfed season. T. M. V. 2 is a slightly shorter duration strain which has been found to come up well in the cold season (December to March). This has in addition to the high yield, the desirable characters of high oil content, dull white seeds and partial splitting of capsules which prevent shattering of seeds at maturity. Strain T. M. V. 3 is particularly suited for summer cropping under irrigated condition. This also contains about 2 per cent more oil than the local varieties.

Trials so far conducted have shown that these strains are suited to the Central and Southern districts. They have not done well in the Circars, Ceded Districts and Malabar where the conditions are quite different.

2. **Optimum spacing:** It has been established that on red loamy soils the optimum spacing for a gingelly crop raised under purely rainfed conditions is 9"x9" and that raised under irrigation is 1'x1'. The optimum seed rate per acre is about 5 lb. for a rainfed and 4 lb. for an irrigated crop.

The Programme for the future. The account of the work done so far will show that much more remains to be done. The following are some of the more important problems awaiting investigation. On the successful solution of these will depend the progress the State can make towards achieving the goal of increased production. The sooner these are tackled the better.

**1. Evolution of strains:** Though the strains already under distribution are yielding better than the local varieties there is considerable room for effecting further improvements. An ideal strain is one with high yield, high oil content, non-deshiscent capsules, uniform maturity and possessing resistance to drought, shoot-webber pest and phyllody disease. Duration and colour of seeds may have to be varied to suit regional requirements. These are easily said but may take years to be brought together in a single strain.

**2. Determination of the optimum manurial and cultural requirements:** The most remunerative and optimum preparatory and intercultivation practices and the manurial requirements of the crop will have to be determined with reference to soil types and seasonal conditions. No reliable information is at present available on these aspects.

**3. Spotting out of suitable mixtures:** The popularisation of growing crops mixed with gingelly whereever possible has been suggested as one of the ways of increasing the acreage under the crop. However, before advocating this practice it is necessary to gather information regarding the probable areas where this can be introduced and to spot out compatible and remunerative mixtures for the different areas.

**4, Control of pests and diseases:** The evolution of high-yielding varieties resistant to pests and diseases is undoubtedly the most acceptable and desirable way of solving this problem, but this is an item of long-range research and may take years to achieve tangible results. Meanwhile, it is necessary to find out cheap and praticable control measures which are within the reach of the ryots, particularly to tackle the shoot-webber pest and phyllody disease.

The problems suggested above relate only to field investigations. No mention has been made on the extension side of the work, though it is equally important if the ryots have to enjoy the fruits of research. There are also problems like the storage and deterioration of seeds etc., which need investigation. The extent of damage caused to the seeds at present by insects and vermin during storage and subsequent movement from the producer to the consumer does not appear to have been sufficiently appreciated. Nevertheless, it is considerable. Any improvement which it is possible to effect here will make even the present supply available to a larger number of people.

**Regionalisation of Research:** Gingelly crop is now being grown under widely different climatic and soil conditions in the State and gingelly varieties are almost always tract and season-bound. As already mentioned the strains evolved at Tindivanam are not found suitable in the Circars, Ceded Districts and Malabar. The experience gained has underlined the need to conduct research on a regional basis if we are to secure improved strains or suggest improvements in the present method of cultivation and manuring.

Taking into consideration the immediate needs, the establishment of a Regional Research Station for gingelly improvement work in the Circars should receive top priority. Possessing as they do nearly 50 per cent. of the entire gingelly acreage of the State, the Circars have to be given more serious attention than what it has been possible to give so far. Similarly, work has to be initiated in the Ceded Districts also. Without regional Research Stations, to serve these distinct areas it may not be possible to make much headway in gingelly improvement in the State.

**SUMMARY:** Gingelly (*Til*) or Sesame is an important oilseed crop of the Tropics grown exclusively for its seeds, which yield an oil of excellent quality. The crop is cultivated to a large extent in the Indian Union, where it is ranked third in importance among the oilseed crops cultivated. The Madras State with a normal area of about 7 lakhs of acres under the crop and an estimated annual production of 80,000 tons of seed accounts for 17·7% of the area and 29·7% of the production of India. Gingelly oil is in considerable demand throughout the country, particularly in the Madras State, mostly for culinary purposes. A review of the available statistics regarding the production and utilisation of seeds in the Madras State, has shown that the present production falls considerably short of her requirements. The possibilities of stepping up the internal production to make up for the present shortage and to provide for future requirements have been explored. Increasing the acreage under the crop, though feasible, is shown to have limitations, and unreliable as a basis for drawing up any definite plans. On the other hand, there is considerable scope to increase the yield per acre. The factors that go to make large yields in general are known but basic data on which specific recommendations have to be drawn up for adoption by the ryots are lacking as no research work has been done on this aspect. The contribution of the Oilseeds Section to gingelly improvement in the State has been referred to and the lines on which work should develop in future have been indicated. The need for doing research work on gingelly on a regional basis is brought out.