

Groundnuts and Their Cultivation

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Groundnuts form a considerable item in the exports from the Tanganyika Territory, usually taking fifth or sixth place in order of importance. At present, production is mainly confined to native cultivation in the drier central and north-western areas, but it is suggested that were planters more familiar with the crop it would find a place in other parts of the Territory on many of the holdings which commonly grow cotton as a cash crop.

THE PLANT.

The groundnut (monkey-nut, peanut) (*Arachis hypogea* Linn.) belongs to the family Leguminosæ and is a species of the sub-family Papilionaceæ. The origin and history of this plant is lost in antiquity. It is supposed to be a native of Brazil. Slave ships are said to have carried it to the west coast of Africa, from whence it was later introduced to the North American continent and to the East. The groundnut is remarkable in that, after fertilization, the flower stalk elongates and turns down, pushing into the ground, where the pod develops and completes its growth.

VARIETIES.

The varieties of groundnut fall into two main groups:—

- (a) The "bunch" or erect growing varieties.
- (b) The "runner" or prostrate creeping varieties.

The main value of the groundnut is in the oil which it contains—about half of the weight of the kernel is oil. In general the runner types yield better and have larger kernels than the bunch varieties, but the latter have three big advantages over the runner in that they contain more

oil, they mature earlier, and are easier to harvest because the nuts are all produced close to the root of the plant and can be gathered up with little trouble.

CLASSIFICATION OF VARIETIES.

In Tanganyika we have numerous representatives of the runner and bunch types, and occasionally one comes across the semi-erect type, such as the "Mwitunde" variety grown in Usukuma. This variety cannot really be classed as either a true bunch or runner.

• Introductions of varieties which are cultivated successfully in other countries have been made by the Department of Agriculture, and one of these varieties, namely the Virginia Bunch, has proved useful under conditions in the Sukuma areas of the Lake Province.

The following classification of recommended varieties may be found useful:

TABLE I

	GROUP 1 Virginia Bunch (Union)	GROUP 2 Man- yema Bunch	GROUP 3 Kalande
Type of growth . .	Bunch	Bunch	Runner
Period of growth	100 days	125 days	150 days
Average yield per acre (under Lake Province conditions) . .	700 lb.	700 lb.	1,000 lb.
Colour of skin of nut	Deep red	Light brown	Pink
Usual number of nuts per pod . .	2-4	2	2
Percentage nuts to pods . .	73%	73%	63%
Percentage of oil which may be expected from nut	49%	49%	44%

Virginia Bunch.—This variety was introduced from South Africa, is drought resistant, and a very useful type for farming with machinery. It has been grown in many parts of Usukuma and Unyamwezi for the past six years, and on the generally worn-out soils of those areas a yield of about 700 lb. of pods per acre has been obtained. The Virginia Bunch variety can often be cropped at ninety days, thus allowing of catch-cropping and a wide range of planting dates, so useful to the farmer in areas of uncertain rainfall. Two disadvantages exhibited by the Virginia Bunch should be mentioned here. These are: (a) hardness of shell, making hand shelling of this type a very slow business; (b) a tendency to produce second growth should rain fall after a dry spell towards the end of the growing season.

Manyema Bunch.—This useful bunch variety is grown by the natives of Unyamwezi, and was introduced to Ukiriguru from the Kahama district in 1933. Manyema Bunch is a medium early type, is easy to shell, and does not produce re-growth under ordinary conditions.

Kalande is the common name given to the favourite runner variety of Usukuma, and is the kind responsible for the bulk of the Lake Province groundnut crop. It is easy to shell, gives a good yield, and does not produce re-growth. The disadvantages of this and other runner types are difficulty in harvesting and late maturity. If the early rains are poor, little success can be obtained with the Kalande type.

Akola Selection No. 10.—This variety was imported from India in 1933, and is a strain of Spanish Bunch evolved for growing on Indian black soils. It may prove useful here in extending the range of soil types commonly used for ground-

nut production. Akola Selection No. 10 is similar in habit to Manyema Bunch.

Philippine White.—A variety selected for resistance to rosette disease. The following table, compiled from the Ukiriguru Station 1934 Report, shows the degree of resistance exhibited by this variety in comparison with the types already mentioned.

TABLE II

VARIETY	Percentage Rosette Infection
Virginia Bunch	25
Akola Selection No. 10.. .. .	18
Manyema Bunch	20
Kalande Runner	30
Philippine White Runner	8

The three main uses to which the groundnut is put are:—

- (1) The sale of kernels for crushing. A ready demand and marketing facilities exist in Tanganyika.
- (2) The sale of confectionery groundnuts. These are usually sold in the pod to supply a small and specialized market, in which Tanganyika is not at present a competitor.
- (3) The use of the whole crop as a stock feed.

Farmers in Tanganyika who wish to engage in the production of kernels are at present advised to plant the Virginia Bunch variety. The use of the Manyema Bunch and Kalande Runner types under certain conditions should, however, not be lost sight of. For instance, Kalande for early plantings, Manyema for mid-season plantings, Virginia Bunch for main plantings and use after green manure and catch crops. At present, kernels of the above three varieties are purchased for the same price and mixed by buyers.

With large-scale production and separate marketing it should be possible to secure a premium on bunch types which have a higher oil content than the runner type. The latter form the bulk of present-day exports.

CONFECTIONERY GROUNDNUTS.

Special varieties, usually those with large pink kernels, are used for the confectionery trade. Such groundnuts, or peanuts, as they are generally termed, are usually hand-picked selected samples, and are exported unshelled from China, Java and Spain. At present a market is said to exist for special types of confectionery peanuts if produced within the Empire and marketed on a small scale, say two to three hundred tons annually. Confectionery samples usually obtain a preference of £1/5/0 per ton over the usual rates for crushing types, and this with the addition of Empire preference should enable planters to make quite a useful side-line out of five to twenty ton lots.

Investigation as to the values of established varieties has indicated that some of them have possibilities for the confectionery trade. So far, rather divergent opinions have been expressed as to the value of these local types, and the matter can only be decided by fairly large trial shipments.

VARIETIES FOR STOCK FEED.

Farmers who desire to grow groundnuts for stock feed are advised to use the runner types, which produce a fairly heavy growth of haulm and a good yield of nuts. The Kalande common runner type of Usukuma is recommended as suitable for this purpose.

CLIMATIC REQUIREMENTS.

The climatic requirements of the groundnut may be found in most parts

of the huge stretches of this Territory which under natural conditions carry a cover of the Acacia-Commiphora, Acacia grass-savanna, Combretum and Miombo vegetal types. Suitable conditions occur from sea-level to about 4,500 feet, and under rainfall conditions of from 25 to 40 inches. A hot climate, with well defined wet and dry seasons, suits this crop. The amount of rainfall required to produce a crop will depend to a large extent on the variety planted; for instance, at Ukiriguru, in a season when Virginia Bunch types matured on 17 inches of rain, the native Kalande matured on 26 inches. It should be remembered that the groundnut is a drought resister, and gives good yields under quite low rainfall conditions.

PLACE IN THE ROTATION.

If possible, groundnuts should not be planted on the same land more often than once in every three or four years. Few farmers in Tanganyika have as yet adopted any mixed farming rotations, cotton and other annual crops being looked on rather in the light of catch crops. If a set rotation is desired, the following should serve a mixed farm which produces two or three saleable crops and relies on pen manure or compost for the main fertilizer:—

- 1st year.—Green crop, e.g. Dolichos bean, Stizolobium, cowpeas, for fodder or compost.
- 2nd year.—Cotton or tobacco.
- 3rd year.—Maize or sorghum.
- 4th year.—Groundnuts.
- 5th year.—Sweet potatoes.

SOIL.

Groundnuts will grow well on practically all soils that are fertile, well drained, and not deficient in lime. Good crops can be raised on heavy soil if the soil is well

cultivated, but harvesting operations are made difficult, and for this reason such land is best avoided. A good sandy loam is the best; lime is essential, and lack of it results in a large proportion of "pops" or empty pods.

In choosing land for groundnuts, the character of crops planted or the rotation practised during previous years should be considered. The groundnut requires a clean soil, free of roots, stones and rubbish, and should, if possible, follow a cleaned crop, such as cotton, maize or tobacco.

PREPARATION OF LAND.

A very thorough preparation of the land before planting is essential. In the U.S.A. mellow land is ploughed and then harrowed at least three times until the soil is in very fine condition. Such careful preparation is of course particularly desirable in the case of heavier land. Either flat or ridge planting may be practised; the latter being the method adopted by native cultivators.

FERTILIZERS.

Opinions differ as to the manner in which groundnuts should be fertilized. In the U.S.A. it is generally recommended that well-rotted pen-manure should be applied to the previous crop in the rotation; a manured maize or cotton crop, followed by groundnuts, unmanured, should be satisfactory.

In India, sheep and cattle are sometimes folded directly on the land, 1,000 head of sheep being used to manure one acre in a night. As regards artificial manures, experimental work in India has shown that 70 lb. per acre of 50 per cent potash is the most profitable fertilizer to use. The potash is broadcast at the time of sowing.

SEED.

Good seed is very important; seed which has been heated or bruised is unlikely to germinate. Expert groundnut-growers in the U.S.A. make a very special point in the correct harvesting and storing of seed groundnuts. Good seed is selected from the best part of the field, and cured in small stacks for at least eight weeks. (A shorter period will suffice in this Territory.) After curing, the pods are picked from the vines and carefully stored. Careful shelling of groundnut seed should be done close to planting time. Most native growers in Tanganyika adopt care in the storage of their seed, which is commonly left in closely woven or dung-smearred grain baskets. In Usukuma, the basket of pods is covered with a layer of grass and then the vessel is closed with a thick layer of cow dung.

SOWING AND PLANTING DISTANCES.

Success or failure of the groundnut crop will largely depend on how it is sown. Two very important factors to be considered in each area are the time of sowing and the spacing to be adopted. The general practice is to plant the crop so that vegetative growth is completed during the rainy season, so that ripening takes place in the early part of the dry season.

The normal type of season experienced in the groundnut areas of Tanganyika giving some six months of variable rainy weather, enables the native cultivator to raise crops of late maturing runner types. These are usually planted some two months after the start of the rains, and are ready to harvest at the beginning of the dry season. In some parts—for example, in Unyamwezi, where early maturing native types exist—planting usually takes place early in December or January and the produce is harvested before the end of the rains, while a main

crop of the runner type is commonly sown in the normal manner at the commencement of the dry season.

It should be remembered that the runner type of groundnut takes about five months to reach maturity, so that an early start is desirable, in order to give the crop about four months of good growing weather. With bunch types, which need about five and a half months to reach maturity, two crops can sometimes be raised off the same land in one season, or catch crops may be taken off before or after the groundnuts. The great value of this type in a risky climate is due to the fact that successive sowings can be made, thus spreading the risk of crop failures due to poor rainfall and other factors which may occur seasonally.

Planting distances will depend on the suitability of soil and climate, the type of tools used in cultivation, and the sort of seed used.

In the U.S.A. wide row spacings are resorted to, in order to enable the maximum amount of inter-row cultivation to be performed. In general, wide row spacings, 32 to 42 inches, are used, but the seed is dropped very closely in the row—3 to 7 inches apart. In the Lake Province, spacings of 24 inches by 6 inches have proved satisfactory for Virginia Bunch, enabling inter-cultivation to proceed comfortably until the crop has flowered. For runner types spacings of 3 feet by 10 inches or 2 feet 6 inches by 1 foot 6 inches are to be recommended.

METHOD OF PLANTING.

Various methods are adopted for the planting of groundnuts:—

(a) Shallow furrows may be opened at the correct distances with a light plough; seed is then dropped by hand and the land lightly harrowed.

(b) If ridge cultivation is used, seed may be pushed into the soil at requisite distances.

(c) A “knocker” and “dotter” may be used. This unique implement is a home-made device, and comprises two sections of a log, which serve as wheels. Wooden pins are inserted at the required spacing distances between plants, on the circumference of the wheels, in order to make “dots” or holes for planting at each revolution; two shafts are braced in front of the wheels to hold them steady. The “knocker” is a log of wood, about six inches in diameter, which is secured below the shafts in front of the wheels; this log breaks down any clods, and levels off the ground in front of the “dotters”. If desired, a single “dotter” may be used; this implement resembles a wheelbarrow without the body, and can be run if required amongst trees and stumps. Seed is dropped into holes made by the “dotter” and covered by the planting gang.

(d) Groundnut planting machines and adaptations of maize and cotton planting machines are in general use where groundnuts are farmed on a large scale, and are to be recommended for the planting of anything over fifty acres.

DEPTH OF SOWING.

Seed should be covered to a depth of 1½ to 2 inches on light soil, and 1 to 1½ inches on heavy soil.

INTERCULTIVATION.

Correct cultivation of the growing groundnut crop is most important, and should begin as soon as the rows can be seen, and continued until the vines begin to cover most of the ground.

For the first cultivation a light turn-plough can be used to get close to the plants and to throw the earth into the middles; this leaves the young plants on

a ridge from which the grass and weeds can be chopped out at the first hand-hoeing. A little later the second cultivation can be given, using the common tine cultivator, when the earth in the middles is levelled off and brought up close to the plants.

Subsequent cultivations and hand-hoeing will depend on the state of the land, but as soon as the plants begin to peg, that is, to send down their peduncles on which the pods form, great care should be exercised, otherwise the young pod stems may be cut. At this time only the middles should be cultivated in order to work a little loose earth under the plants. If weeds are prevalent hand weeding should be given; most of this will have to be hand pulling of weeds and grass.

The important points are for the grower to see that the soil is kept loose, free of weeds, and that no damage is done to the young pods as they form.

TIME TO HARVEST.

Ripeness in the groundnut crop is indicated by the wilting and yellowing of the leaves, and the dying off of the small leaves in the centre of the plant. In order to judge accurately, a few pods should be dug up and examined. If the kernels are full grown and the inside of the shell has begun to colour, the crop is ready for harvesting. The correct harvesting of bunch varieties is important, as delay in lifting, once the crop is ripe, may result in the germination of the new crop of kernels.

LIFTING THE CROP.

The groundnut crop may be harvested in many ways. If hand labour is used this operation will become a heavy item of expense. It is advised therefore that in all cases machinery of some sort should be

used to harvest the crop. A simple method is to use a light plough to lift the plants; this operation is particularly easy when dealing with bunch types. If possible, the plough should be fitted with a long narrow wing and a small mould-board, in order to cut the tap root and loosen the vines without throwing much earth on them. Potato-diggers of the elevator type, or special attachments to ploughs, may be used to advantage.

No more of the crop should be lifted in a day than can be stacked in a day.

After lifting, the vines should be shaken free of earth by labourers using pitchforks.

If the weather is fine and dry, stacking may start about two hours after lifting.

Under African and Eastern conditions, stacking is rarely adopted owing to the lack of attention paid to fodder conservation and the fact that harvesting is normally carried out in well-defined dry seasons. Most farmers should find it well worth their while to stack in order to save the hay, protect the crop from the possibility of rain damage, and be in a position to be able to pick the pods from the vines as occasion arises.

Stacks are made by setting up poles which have two crosspieces a few inches above the ground. Small poles, about 7 feet in length and 3 to 4 inches in diameter, sharpened at both ends, are favoured; crosspieces are 1½ feet long and nailed at right angles one above the other.

Stakes are set into the ground after the rows have been dug. They should be set into well-dug holes, and the soil firmed round about them; crosspieces are then nailed on from about 10 inches above the ground upwards, allowing about three crosspieces per pole. Fifteen to

thirty stacking poles will be required per acre.

Stacking is best done with a 6- or 8-tine fork. Vines are gathered up on the fork and brought to the stack pole, round which they are placed at a suitable distance with their roots towards the pole. The stack is started by laying a few vines on the crosspieces to form a foundation, after which it is built up by packing the vines around the pole by hand, keeping the groundnuts to the inside. The middle should be kept up and the stack bound every now and then by putting vines round the pole, and when finished the stack should be topped up by a few vines or weeds.

CURING.

The crop should be left in the stack until thoroughly dry. In the U.S.A. stacks will stand as long as a month or six weeks before picking starts.

PICKING AND CLEANING.

Groundnuts are best picked when the vines are dry and brittle; damp weather causes the vines to be tough and makes it difficult to pick off the pods. Hand-picking is now a thing of the past in the peanut-growing areas of America. In Tanganyika, with cheap labour conditions, picking is possible with hand labour, which should not cost more than one half cent per pound of kernels. For regular large-scale production of, say, over one hundred acres, groundnut picking machines should be used.

Groundnuts are exported in the shelled state from East Africa for the crushing trade. Very few buyers of unshelled nuts exist in this Territory, so that the intending planter will have to purchase one of the many types of shellers, either power or hand driven. A cheap but serviceable machine used in the groundnut-growing

areas of India, known as the "Sangali" sheller, costs up to £30 (in India), and is capable of shelling 8 to 15 bags per hour at a cost of Sh. 2/50 to 7/50 per ton of kernels. Small hand shellers are also made and can be purchased for a few pounds. For small-scale production, say up to 10 acres under groundnuts, the "Tom Houston" sheller will be found useful, but once the planter has gained confidence and intends to go in for groundnut farming properly he should consider the purchase of a small power sheller.

A comparison between hand shelling and machine shelling with the "Tom Houston" sheller—a machine costing Sh. 25 only—is given below:—

TABLE III

GROUNDNUT SHELLING COSTS AT UKIRIGURU
EXPERIMENT STATION

By Machine ..	Two men can shell 1 ton of groundnuts in 6 days, the winnowing of this amount would take two men 9 days.
By Hand ..	One man 105 days to shell 1 ton.

Thus this cheap Sh. 25 machine although it does not winnow can do the work $3\frac{1}{2}$ times as quickly as by hand.

MARKETING.

Exporters of groundnuts in Tanganyika buy the crop on the railway or at the coast. Their main difficulties are the smallness of the crop and the competition for it. The kernels are bagged at the rate of twelve bags to the ton, and exported in as fresh a condition as possible.

VERMIN.

In Tanganyika the main pests of groundnuts are vermin, such as pigs, porcupines and spring hares, which cause considerable damage in certain areas.

Control methods advised are poisoning with baits prepared with strychnine or arsenious oxide.

PLANT PARASITES.

In the groundnut-growing areas of Unyamwezi and Usukuma, a yellow-flowered parasitic weed, *Alectra abyssinica*, is very destructive to groundnuts and other common legumes. Eradication may probably best be effected by trap cropping or continued hand pulling before the parasite can flower.

PLANT DISEASES.

The most important plant disease of the crop in Tanganyika is undoubtedly rosette disease. Rosette disease is a virus carried by an insect, *Aphis leguminosæ*. The disease is believed to survive from one season to another in diseased plants which are left in the field between seasons.

Plants attacked by rosette disease become stunted. The internodes and the leaf petioles are shortened; the leaflets commonly dwarfed and twisted. The diseased leaves become yellow. When part of the leaf is yellowed and part remains green the typical rosette effect is produced. The work of Storey in Uganda has thrown much light on the factors which affect the control of this disease.

Rosette disease has been controlled by the following methods:—

- (a) Delayed weeding.
- (b) Spacing the crop as closely as is compatible with the variety chosen.
- (c) By the use of rosette resistant varieties.

USE OF GROUNDNUTS IN STOCK

FEEDING.

Groundnuts and groundnut hay form a nutritious feed for stock, as will be seen from the following figures analysis, taken from Bulletin No. 6 from the University of Florida, Division of Agricultural Extension, and the United States Department of Agriculture.

TABLE IV

	Protein	Carbo- hydrates	Fat
Unshelled Ground- nuts	20.4	16.4	32.2
Kernels	25.8	17.5	44.9
Groundnut Hulls ..	7.3	18.9	2.6
Groundnut Hay ..	11.7	46.9	1.8

The following figures analysis on local samples of groundnut vines have been determined by Mr. French, the Biochemist of the Department of Veterinary Services and Animal Husbandry. The vines were collected from native fields, and included a fair proportion of root, while a considerable amount of leaf was lost in handling.

TABLE V

	Mpwapwa Tops	American Figures
Crude Protein ..	7.70	10.60
True Protein ..	6.95	—
Ether Extract ..	1.04	3.42
Nitrogen-Free Extract	49.54	50.05
Crude Fibre ..	31.73	26.85
Total Ash ..	9.90	9.06
SiO ₂ ..	5.63	—
SiO ₂ -Free Ash ..	4.27	—
CaO ..	0.75	—
P ₂ O ₅ ..	0.51	—

TABLE VI

DIGESTIBLE NUTRIENTS PER 100 GM.

Digestible Crude Protein	3.83
„ Ether Extract	0.32
„ Nitrogen-Free Extract	39.16
„ Crude Fibre	14.63
„ Organic Matter	57.94
*Starch Equivalent	48.80
Nutritive Ratio	1:15

*Starch Equivalent if fed unchaffed would be 39.60.

Mouldy groundnut hay should not be fed to stock. Hay is best fed in racks for horses and mules, in order that any sand and dust may sift through.

About three-quarters to one ton of hay is usually obtained per acre.

COSTS.

It is not possible to give actual cost figures in a publication for use throughout this Territory. Up to the present costs have only been taken on experiment stations and seed farms in the Lake Province, where crops have been raised with the aid of simple machinery such as ploughs and inter-row cultivators, drawn by the indigenous zebu cattle.

In general, the following costs will have to be considered by the planter:—

- (1) Rent or interest on value of land.
- (2) Supervision and overhead charges, including depreciation on implements and machinery.
- (3) Fertilizer.
- (4) Seed.
- (5) Stacking poles and bags.
- (6) Costs of ox and man labour used in the following operations:—
 - (a) Ploughing and preliminary cultivation.
 - (b) Distribution of manures and sowing seed.
 - (c) Lifting and stacking.
 - (d) Picking.
 - (e) Cost of shelling.
 - (f) Cost of marketing.

Below will be found a note on groundnut production costs as prepared by Messrs. Rounce and Thornton, of the Ukiriguru Experiment Station:—

Groundnut Production Costs from Mwanza Federation Seed Farm, Mwanza District, Lake Province, Tanganyika Territory: 1932-33 Seasons.

General.—(a) The cost of labour is taken at 4 cents per man hour = 32 cents per full day, whereas actual payment is 25 cents. In practice, 8 hours is not spent on the work, owing to delays in reaching fields, roll-call, rain, etc.

(b) The cost of oxen is taken at 9 cents per day. This includes all maintenance, including growing of fodder, silage and hay, and depreciation on oxen and implements at 25 per cent per annum.

TABLE VII
HAND CULTIVATION OF VIRGINIA BUNCH
GROUNDNUTS

	Cost per Acre
	<i>Sh. cts.</i>
Shelling for seed, by hand	1 93
Ridging by hand	11 75
Planting 3 rows per ridge	2 40
Weeding	82
Pulling by hand	2 97
Harvesting and bagging	5 12
Shelling by hand machine ($\frac{1}{2}$ cent per lb.)	2 41
Expenditure	27 40
Yield per acre unshelled, 733 lb...	
Yield shelled, 483 lb.	
Selling price 6 cents per lb.	
Return	28 98
Net profit per acre	1 58

TABLE VIII
OX CULTIVATION OF VIRGINIA BUNCH
GROUNDNUTS

	Cost per Acre
	<i>Sh. cts.</i>
Ploughing	1 25
Ox ridging	59
Shelling for seed, by hand	1 52
Planting, by hand	2 00
Ox ridging-up	08
Weeding, by hand	2 67
Harvesting, pulling by hand, bag- ging, etc.	8 45
Shelling by machine ($\frac{1}{2}$ cent per lb.)	2 58
Expenditure	19 14
Yield per acre unshelled, 783 lb.	
Yield shelled, 516 lb.	
Selling price, 6 cents.	
Return	30 96
Net profit per acre	11 82

TABLE IX
OX CULTIVATION OF NATIVE CREEPING
GROUNDNUTS

	Cost per Acre
	<i>Sh. cts.</i>
Shelling for seed	88
Ploughing	1 99
Ridging	61
Planting	2 71
Weeding	6 62
Ox cultivation	70
Lifting by plough, stacking in wind-rows, pulling and bagging (rainy weather and very heavy soil) ..	18 92
Shelling by hand machine.. ..	2 99
	<hr/>
	35 42
Yield per acre unshelled, 1,069 lb.	
Yield shelled, 598 lb. (low shelling percentage owing to bad rains).	
Selling price, 6 cents.	
	<hr/>
Return	35 88
Net profit per acre	46

It should be noted that the full advantage of Virginia Bunch is clear when the harvesting costs are compared with that of the native type. A variation of Sh. 10 and Sh. 13 will be noted. Probably this high figure was caused partly by the heavy soil, but to a great extent by the creeping habit of the plant.

YIELDS.

Under fairly good conditions it should be possible to raise 1,000 to 1,500 lb. of unshelled nuts to the acre. Yields of 800 to 1,000 lb. unshelled have been obtained on experiment stations and native authority farms under moderately severe conditions in the Lake Province, and such yields should be easy to obtain where the farmer starts with new land in suitable areas.

VALUES.

Values of groundnuts have recovered considerably of late, and with the present (December, 1935) ruling prices of £13-17-6 per ton in London, the crop

should pay in situations close to the railways or ports, where it can be cultivated as a side-line with implements, oxen and power on land which would otherwise be lying idle.

CONCLUSION.

The claims of the groundnut as a crop for the farmer in Tanganyika are many, but the following are specially worthy of mention:—

- (a) Suitability of huge areas of the Territory for the type of agriculture in which the groundnut plays an important role in other parts of the world.
- (b) An assured and established market for kernels.
- (c) The possibility of farming the crop almost entirely with machinery, thus reducing the risks attendant on so many other crops in East Africa, which at present depend on large supplies of cheap labour.

Those who are interested in the development of native agriculture in their drier areas will find that the groundnut is one leg of the tripod formed by cotton, millet, and groundnuts; and the prosperity of crop husbandry in the dry areas largely rests on this tripod. Lack of seed supplies, impoverished and eroded soils, and particularly the need for either shelling facilities at markets or the introduction of small hand shellers, must be looked to before output increases. The production of any quantity of groundnuts is almost impossible unless the cultivator has a sheller or shelling facilities, and to this fact one may largely attribute the comparative failure of groundnuts to go ahead at the same pace as cotton in the parts of the Lake Province where land and market facilities should make the cultivation of either crop equally attractive. But in spite of the difficulties, one may be almost certain that this crop will

play an increasingly important part in native and perhaps estate agriculture in the dry areas of East Africa.

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A Test of Green Manure Crops.

In the *Philippine Agriculturist*, Vol. XXIII, pp. 543-48, C. S. Alonso describes an experiment, the objects of which were (a) to discover the comparative values of nine green manure crops in the Philippines, (b) to determine the quantity of dry matter they produce, (c) to analyse them for values of N₂ and P₂O₅ in the different stages of growth and development under field conditions. The species used were *Tephrosia candida*, *T. noctiflora*, *Crotalaria juncea*, *C. usaramoensis*, *C. anagyroides*, *Indigofera endecaphylla*, *Phaseolus aureus*, *Vigna sinensis*, *Calopogonium mucunoides*. Most of the information obtained is tabulated under the following heads:—

- (1) Number of days from sowing to flowering and to maturing.
- (2) The average length of roots and stems and the yield of fresh matter in kilograms per square mile.
- (3) Results of turning under green manures to a depth of 30 cm., examined at 14-day intervals.

(4) Relative chemical composition in terms of percentages calculated on oven-dried samples.

(5) Comparative yields of fertilizing materials calculated in grams per square mile of fresh matter.

The records are shown for every month of growth from 2 to 6 inclusive, except for *Vigna sinensis*, which was from 1 to 2½ months. Table 3 shows that within four weeks the green manures turned under had all been eaten by white ants, with the exception of *Calopogonium mucunoides* and *Indigofera endecaphylla*. Further tests indicated that these plants were definitely distasteful to the ants. *Indigofera* has to be buried more deeply than the others or it will sprout and root again. *Crotalaria usaramoensis*, *C. juncea* and *Tephrosia candida* are high nitrogen yielders. *Calopogonium mucunoides* was a low yielder for 3½ months but the highest at 5 months. *Indigofera endecaphylla* was low in nitrogen throughout. Large quantities of phosphorus were found in all plants at the ages of 4 to 5 months.—*Imp. Bur. of Fruit Prod. Hort. Abstracts*, Vol. V, No. 1, Abs. 139, p. 52, 1935.