

Interrelationships and the Allocation of scarce labour
between competing cash and food crop (subsistence)
activities in a peasant economy.

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Introductory and Summary.

G.M. Trevelyan once said:

"Agriculture, is not one industry among many, but is a way of life, unique and irreplaceable in its human and spiritual values".

This paper represents an attempt to concentrate on the wider aspects of the agricultural firm in Uganda - as an economic unit. Most of the discussion centers on the use of farm family labour in the production of both food and cash crops. I have tried to outline some of the institutional and input/output considerations that determine the use of this scarce resource. An example is given for Lango District, Northern Region where a case study is now in progress.¹

To my knowledge this is the first report of a detailed systems approach to Ugandan Agriculture based on actual field information from a specific area.² It is in no sense complete thus measured prices, statistical variation, and analysis in monetary terms is not here covered. Problems are examined almost wholly with reference to the allocation of hard labour. The paper is descriptive, kinds of normative analysis are precluded.

The first section emphasizes the need to view food and "subsistence" production in close relation with the output of cash crops from the farm firm and thus ultimately at the national level. It is emphasized that national cash crop policy (as in the new 5-year plan) can not be isolated from an active policy for food crops. Finally the importance of understanding labour, as the scarce factor, is pointed out.

The second section deals with a general description of the area (Lango) where the quantitative information is derived. The importance of "communal" labour is stressed as well as a comparison of "on-farm" and off-farm activities. Recent innovation attempts which affect the allocation of labour are briefly described. Lastly the Rainfall pattern is discussed and in particular its general effects on the pattern of labour unput in the area.

Section three presents labour data relating to a particular farm which is described as "John Okello's farm"

¹ Credit is also due to the Uganda Government and proponents of the "Small Farm Data Collection Scheme" whose foresight and perseverance enabled the collection of much of the raw information on which the following figures based. These especially include J. Cleave, M. Hall and Ola Prestbakmo.

² Although Judith Heyers quantitative account of a peasant system in Kenya (still in progress) preceded this analysis as did M. Colinson's work in Tanzania.

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(confidence precludes revealing the actual identity of the holder). Respective crop labour input accounts are presented for the holding as well as a yearly pattern of cropping. The pattern of minor crop inputs is shown to be complimentary to that of the cash crop cotton.

Section four consists of three short comments on techniques which can be acquired by the farmer to alleviate labour constraints at various times of the year. Reactions to these practices are seen to be very much conditioned by the wider (social, etc.) characteristics of the system.

The purpose of the paper is to endorse the general argument presented in the first section with the subsequent information revealed in the latter three sections.

Section I. ("Cash versus Subsistence Agriculture")

The cotton growing areas of Uganda have received a great deal of emphasis in the recently published five-year plan. Of the total investment in agriculture (£ million 19.64) a significant proportion will, directly or indirectly, be allocated to projects designed to increase cotton output. An expenditure of £ million 1.7 is allocated to "cotton" and £ million 4.29 and 1.50 to Group Farms and Tractor hire service respectively. Both these latter categories are to concentrate on cotton production as is at present the case and as has been indicated for future policy in the "plan".¹ Thus roughly 40% of total planned expenditure in agriculture may be construed as focused on stimulating increases of the cotton crop.

Food crops receive rather a "generalized" treatment in the "plan", since crops such as millets, sorghums, sweetpotatoes, simsim, beans, etc., are mainly produced for "farm" consumption their treatment in agricultural planning is not thought important and they have been relegated to the assumption of a 3.2% growth rate.

The "plan" states:

"It is hoped that through the establishment of the Agricultural Produce Marketing Board and the improvement in communications it will be possible to greatly increase the cash incomes derived from these foods."²

It has long been realized in Uganda that an understanding of cotton crop production is dependent of knowledge of the kinds of farming system from which output emanates. It has also been made clear that in Uganda, as in most places in Africa, systems of agriculture have not been sufficiently examined and our knowledge is yet sparse.³

³It is Estimated that at present 75% of T.H. and G.F.cultivations are on cotton land.

⁴ P.70 under "food crops" which are treated in aggregate.

⁵ See W.T. Newlyn Report of The Economic Advisor, 1959. see P.27.

Therefore cotton output is dependent on minor crop production and probably not vice-versa. This has not been recognized in the agricultural section of the plan. No research expenditure has been allocated to the study of Uganda's farming systems and, very little research expenditure is included under agriculture in the plan.

The improvement of Cotton output will be dependent on how economic policy (the governments "command" variables) is brought to bare on agricultural systems. The success of Mechanization, either through Group Farms or Tractor Hire service is to a large extent conditioned by its impact and usefulness in present agricultural systems. If this is limited, much more significant policy decisions must be made (changes in tenure rights, consolidation, etc.) but since these have so far been avoided, the problem can adequately be discussed in the context of present systems.⁶

It is a notable fact that cotton production in Uganda has not demonstrated any trend increase over the past several decades. While acreage was transferred to coffee in Buganda and parts of Busoga, this decrease has just been made up by the expansion of acreage in other regions. Yields have remained low and highly variable, the effect of extension service advice appears to have been slight. Subsistence crop output has not decreased as a proportion of total crop output even in areas of heavy cash cropping.⁷

According to the National Plan:

"At the moment almost one quarter of total output derives from the subsistence sector. Basically the subsistence sector is a passive element in the economy. Eventually it must be reduced to minor proportions, its function as a method of feeding the rural population being superseded by a more efficient agricultural organization based on increasing specialization."⁸

The plan goes on to assert:

"As the population continues to grow it is to be expected that, for some years to come, subsistence production will actually grow. This growth will be only modest and it is probable that, in time, it will be followed by an absolute decline subsistence production will become a smaller and smaller proportion of total product, declining from 24 per cent in 1966 to 21% in 1971 and 14% in 1981."⁹

It is perhaps difficult for the macro-economic "planner" to see subsistence production as anything but a unique set of accounts given in National Statistics. A brief inquiry into the derivation of these "sectoral" figures would reveal just how inaccurate they may be.¹⁰

⁶ This point is discussed in both the content and conclusions of "Symposium on Mechanical Cultivation in Uganda" 1960, edited by J.L. Joy.

⁷ As revealed in The Real Growth of the Economy of Uganda 1954-1962 Statistics Division of Ministry of Planning and Community Development 1964.

⁸ Page 5 of chapter 1. "Problems of the Economy and the Strategy for Development".

⁹ Ibid. ¹⁰ As has been strikingly revealed by work under the Ministry of Agriculture and Co-operatives in connection with the recent Uganda Census of Agriculture. See volume 1 page 1. (Entebbe 1965).

Aside from questions of the accuracy of subsistence accounts data, anyone with a basic knowledge of tropical agriculture should be aware that subsistence agriculture is a sector in no economic (allocation of resources) sense of the word and that its expression as such in national accounts is based on convenience and not conception. Unlike the units of most industries the agricultural firm is, almost indelibly, a multi-product enterprise and its various physical outputs--whether "for subsistence" or for "cash" must compete for scarce resources (usually labour in Uganda), the productive equilibrium being determined by considerations of relative profit (in cash or kind) based on the availability of fixed resources, the cost (in cash or kind) of variable resources, and the input/output structure of the system.

Thus the subsistence on food crop sector is in no way "passive" in its relationship to developments within the small agricultural firm such as exists in Uganda. Indeed it may be the unrecognized "key" to significant economic development. In this sense at least one is bound to agree with the National Plans emphasis on increasing marketing facilities for minor crops although what the 21% and 14% figures given for 1971 and 1981 respectively are based on is a moot point.

Anne Marten, in her book The Marketing of Minor Crops in Uganda,¹¹ describes the need to understand more about relative labour costs involved in the cultivation of both cash and food crops. This is because labour and land appears to be the limiting factor in Uganda.¹² She states:

"To understand more of the economy of the individual farm, therefore, it is essential to have more figures of relative labour costs for different products, under the normal conditions of peasant farming, than we have now"¹³

She goes on to say:

"Knowledge of labour costs is of the most direct relevance to any marketing survey since, until we know the real cost of production we cannot form a sensible decision as to whether or not inadequacies in the marketing system are a serious inhibition to greater output"¹⁴

The following section of this paper is strictly a "positive" micro analysis of some interrelationships in the productive structure of Lango, a major cotton producing district. For the most part, interrelationships are illustrated by examining the demands which both cotton and food crops make on scarce labour, the Analysis is focused on the farm firm as a whole.

Section II. General Characteristics

The studied is Lango, a major cotton growing district of The Northern Region. It is a place yet poor by national material standards where the tin (mtati) roof and the bicycle remain signs of commercial prestige. Although the Langi are an ambitious and energetic people, the region is still bound by traditional social customs which inevitably condition the economic environment. Principally these customs encompass communal labour and its payment in beer (wangtic), communal grazing, hunting (arum) and cultivation rights (aker), and certain social obligations (funerals, weddings, etc.). An interesting custom which is nowadays relatively less

¹¹ H.M.S.O. London, 1963.

¹² Also mentioned in Newlyn. op. cit. p. 28.

¹³ Page 2. ¹⁴ Ibid.

important fixed times of planting by movements of the stars and the emergence of several species of white ants during the cultivation year.¹⁵

The extent of "communal labour practice" in Lango compared to other regions was indicated by the recent agricultural census.

extracted (from) Table VIII.8. Holders who Participated in Communal Labour Schemes.¹⁶

Eastern Region	33.2%
Basoga	21.9%
Bukedi	30.4%
Bugisu/Sebei	26.3%
Teso	57.2%
Western Region	32.6%
Kigezi	59.1%
Ankole	14.1%
Bunyoro	18.9%
Northern Region	47.0%
Lango	72.7%
Acholi	31.9%
West Nile/Madi	32.3%

Not all communal labour in Lango is paid reciprocally in kind. (Wangtic-pur Kongo = for beer or less common pur gweno = for chicken).¹⁷ There is commonly a great amount of straight reciprocity which would not be recorded in the census. (usually ALEA). Thus it is not surprising that a minimum proportion of cash is paid to "off-farm" labour in Lango. Again to extract and condense from the census results:

(from Table VIII 2 and VIII 3 p. 58)

Percentage of labour by Form and Basis of Payment***

Region.	Form of Payment		Basis of Payment		
	Cash	Kind	Task	Hour or day	Week or month
Uganda	54.5	45.8	51.9	11.5	42.3
Buganda	97.1	4.9	11.8	3.2	91.4
Eastern Region	34.5	65.1	73.9	12.2	17.6
Western Region	87.8	11.6	37.8	11.9	66.4
Northern Region	16.8	82.7	75.9	19.9	7.2
LANGO District ¹⁸	13.0	87.0	90.0	4.5	5.5

¹⁵Of the stars (Acjer) principally AETOP (Jupiter) and the milky way (Oro=wet cwir=dry) which signal time for millet digging. First rains white ants (Kot Ngen) and bird (Tong Pur) indicate millet planting and a smaller white ant (Okuba Oleyo Nge Gweno) emerges at the necessary time for planting beans simsim and heaping potatoes.

¹⁶Report on Uganda Census of Agriculture Volume, I, 1965, Entebbe.

¹⁷An interesting less-well-known category of Wangtic is called "DIRA" where labour is given to a distraught farmer for deferred payment in kind. Curiously enough very few defaults occur to this kind of labour credit.

Both communal and the small amount of hired labour is engaged sporadically and takes place over distinct and relatively short periods of the year.¹⁹ Labour is thus not hired on a "capitalistic" basis as we often think of the term but rather as a pooled means of overcoming certain well-defined bottlenecks in the annual production process. If I may for the last time extract and quote from the census (although my own results are similar I find the census a somewhat more substantial authority for generalization).

(from Table VIII. 5 p.61)

Main Purpose of Labour.

	Herding Cattle	Weeding Cotton	Picking Cotton	Weeding Coffee	Picking Coffee	All Others
Uganda	34,354	204,302	50,784	138,085	57,610	241,186
Northern Region	2,436	61,908	19,007	1,362	2,335	75,742

(from page 62)

"Of the 62,000 holders of the Northern Region who described weeding cotton as one of the main purposes for which they required labour, 50,000 were located in Lango District. Also 18,000 of the 19,000 holders in this region who described picking cotton as a main purpose for labour were located in Lango district"

Therefore it is clear that labour constraints arise in the district during certain stages of the growth and the harvesting periods of the cotton crop. The relative times spent in various pursuits off the farm for a sample of farmers in the area over two years were revealed as follows:

Table I.

Average farm's hours spent in a year on various activities							
	Communal labour	Hunting fishing	At Market Co-op. or Society	At Relatives or Friends	Social Ceremonies	At Hospital or Dis- pensary	Total
First year	455	37	265	1077	521	100	2465
Second year	625	105	243	981	373	95	2423

Source: analysis of small farm survey in the area.

Through time the average distribution of off-farm labour has been calculated over two years.

¹⁸Figures slide rule accuracy.

¹⁹See Census table VIII 4. p.60.

***These figures are in general agreement with the results of two micro-studies to be discussed below.

Table 2.

Average farm's in distribution of "off-farm" activities

	J	F	M	A	M	J	J	A	S	O	N	D
First year	230	205	216	225	236	194	220	233	194	171	175	166
Second year	218	216	223	228	179	206	206	197	234	201	189	146

Source: same as previous table.

From table it is not surprising that visits to friends and relatives is as important as it is everywhere. Communal labour runs relatively high while other activities are less time consuming but no less important. Time at markets and the local co-operative society is fairly stable over the two year period and, of course, an essential undertaking. The distribution over time of off-farm activities is surprisingly smooth and stable.

The time distribution of "on-farm" labour input exceeds "off-farm" activities at certain crucial production periods of the year. These correspond with the general information revealed by the Ministry of Agriculture/FAO census investigations in the district. The bottleneck periods are June and July when millet is harvested and cotton planted (in that order of importance) and in December when cotton harvest is at its peak, February and March are slack labour periods when the arid dry season precludes much cultivation activity.

Table 3.

Average "On-Farm" labour inputs

	J	F	M	A	M	J	J	A	S	O	N	D
First year	220	112	130	165	258	210	305	230	198	182	160	240
Second year	185	95	88	150	195	190	320	232	223	172	199	215

Source: same as above.

A graph plotting both the seasonal pattern of "off-farm" and "on-farm" labour is included in appendix 1 schedule 1. It shows that "on-farm" activity is roughly equal in time to off-farm activity throughout most of the year although at certain peak production demand periods, "off-farm" labour drops relative to "on-farm".

Communal labour is distributed in much the same pattern as "on-farm" labour indicating that we may expect the amount communal labour off-farm obligations to roughly parallel the respective communal labour inputs which the farm receives.²⁰

²⁰This assumption is made on more detailed grounds than are here discussed. Also specific reasons for prevalence of the custom are not here covered.

Both communal and "on-farm" labour is worked on more or less a task basis. In general, depending on the severity of the work and the pressure of production a task takes from $3\frac{1}{2}$ to $4\frac{1}{2}$ hours to complete. The mean measured task length is approximately 4.05 hours continual work. Sometimes work is all accomplished in the morning (usually between 8 and 12) and often it is split between several hours in the morning and slightly less labour late in the afternoon.²¹

The use of casual hired labour (separate from communal obligations) does occur although it is limited in extent and, in peak seasons, difficult to acquire. As with communal labour, hired labour tasks are defined over a given area by allocated measure with a slender pole of fixed length or, in the case of rowed crops, so many rows weeding or picking to the end of the plot.²²

Production innovations and techniques have penetrated slowly into Lango. Ox cultivation is not intensively used although it is spread throughout the district. At present the ratio of ploughs to the number of holdings is approximately one to four. Holders without ploughs often rent ploughs and Oxen from neighbours at a price of approximately 40/- per acre ploughed. Ox cultivation techniques are much more prevalent in the Southern areas bordering Lake Kyoga and Teso where use is widespread and intensive.

The Number of Ox ploughs in Lango²³

1930	68
1931	156
1932	203
1938	2,250
1947	6,056
1949	9,188
1960	14,484
1963	16,300

In 1959 an intensive program was begun to encourage Ox cultivation with subsequent government subsidy and delivery schemes. A comment on the impact of Oxen is made later in the paper.

In 1958 cotton spraying was introduced at the district level²⁴. This program, continued to the present has involved the agricultural department in the selling and subsidizing through grants and loans of spray and pumps.

In 1961 all pumps and spray were subsidized at a 50% rate and in early 1962 the government's share of the retail spray cost was raised to 80% reducing the cost to the farmer from 40/- to 10/- and subsequently in June to 5/- and in August - free. Since then there have been efforts to tie

²¹The daily distribution of communal work depends on whether it is wangtic, pur.kongo, gweno, or alea. Most such work occurs late in the afternoon when a beer party follows.

²²The plots on which communal labour is used are roughly of like area (standard deviation of the sample was less than 10% of the mean). Length of pole for measuring out task areas varies from place to place but is uniform within a wangtic group. Supervision and allocation of tasks is undertaken by the Rwot or Jago wangtic who is the group leader.

²³Parsons, D.J. The Northern Systems in Memoires of the research division Dept. of agric. series 3 no. 3 1960 p.23. (1963 is district estimate).

²⁴Reported in greater detail by M. Okoi, Time and Energy Study of Hand Cultivation methods in Uganda - unpublished report, Faculty of Agric., Makerere.

spraying in with the early planting of cotton but these have not been successful. In 1964 and 1965 the 100% subsidy was reduced to 50% (16 shillings cost to farmer) but this has been changed again this year as cost to the farmer is now 5/- per tin.²⁵ Extension workers continually argue that for spray to be effective economically, cotton must be planted early.

Tractor use and cultivation method are also received much policy support. Some comments on these follow in the latter part of this paper.

District Records of "minor" crop acreages and of mean plot size for various crops are only very rough estimates. The main crops grown other than cotton are finger-millet(kal), simsim (mino), cassava (mogo), sweet potatoes (icok), ground-nuts (amaido), and not so often, songhum (bel). Mixed beans are invariably inter planted with cotton as are pigeon peas with finger millet, both combinations being sown for the first rains.

Cotton production, price, and to a lesser extent, acreage over a long series of years are fairly well documented. Appendix 1, schedule 2, demonstrates the longer term increasing trend in overall cotton production.²⁶ Price to the grower for cotton has also changed over time. It rose steadily after the war reaching a high plateau during the past several years.

Schedules 3 and 4 of Appendix 1 illustrate that farmers in Lango reacted fairly rationally to price changes by varying their cotton acreage (acreage planted related to price lagged one year). Schedule 3 is a scatter diagram of price on acreage with a free hand (logarithmic) curve drawn in roughly according to minimum vertical distances. Although the fit is far from spectacular the farmers rational can perhaps best be seen by examining the graph of schedule 4 which indexes the two variables over time from 1934 to 1948 - a period in which price under went considerable variation.

Acreage planted to cotton (Appendix 1 Schedule 5) indicates that after a very rapid expansion from 1946 to 1949, cotton acreage fluctuated about a mean of 190,000 acres planted. To a certain extent cotton was also substituted for simsim as the export market for the latter crop dried up due to increased use of cotton seed oil in East Africa. Principally because of yield variations, the per acre gross revenue of cotton has fluctuated widely as indicated in appendix 1 schedule 6.

The graphs demonstrate that the system is not strictly of a given subsistence base with cash cropping "tacked" on - this being only allocated the "residual" resources. Indications are that as farmers became more aware of cotton possibilities and as price rose - more and more labour was allocated to the crop. This was conditioned by "wants" generated for material goods which could only be bought for cash. There was also "competition" for scarce labour between cotton and other (subsistence) crops in the system and farmers allocated their labour (reflected in acres cultivated per crop) according to

²⁵The scheme this year is plagued by problems of finance and although 5/- per tin is the policy - some farmers could not secure their tins at that price and higher prices have been paid at Lira.

²⁶Parsons, op. cit p.21 quotes Driberg (The Lango, T. Fisher Unwin London 1923) as saying that when cotton was introduced in the area the Langi, were not considered by him to hold much promise of large production "due partly to the unimense quantities of simsim which are cultivated annually for export".

the price and market, therefore considerations of crop "profitability". This latter term had relevance to the farmer in kind as well as in cash.

The Rainfall pattern over most of Lango is bimodal although the two rainfall peaks occur in temporal proximity (April and August). Therefore two shorter period maturing crops may be grown over the season on one piece of land but cotton requires both the long (early) and short (late) rains. Both the extent and distribution of rainfall over time are highly variable. However in only a few periods of the year can water deficits be regularly expected (Jan., Feb.).²⁷

The variability of the rains to a very large extent determines cash and food crop yields in the area. Some crops such as Sorghums and Cassava are less susceptible than others (Millet, Cotton and especially Groundnuts). Relationships of yield and expected rainfall are important but little known empirically. Weather Cotton by hypotheses have been quantitatively examined at the Namalongo Cotton Research Station by the use of multiple linear regression in an effort to predict cotton output on the basis of certain weather variables.²⁸ The results however, have not been entirely successful.²⁹

The rainfall pattern also partially fixes the periods of cultivation labour intensity throughout the year. Rain is a productive input over which the farmer has no control but which exhibits a regularity on which cultivation decisions must be fundamentally based. This is illustrated in appendix 1 schedule 7 where the three weeks moving average rainfall distribution for Ngetta, Lango (1.1 confidence limits) is contrasted with the pattern of total cultivation labour inputs for the area throughout the year, omitting harvest requirements. Crops are planted to coincide with the advent of either the longer first or shorter second rains.

Thus as the rains begin in late march millet (and peas) and cotton (and beans) are planted and require heavy weeding subsequently. For the second rains groundnuts sorghum are the main crops. The high cultivation labour intensities in December and January (dry arid months) represent cotton harvest requirements (these are not included in the graph above).

Section III. The Typical Farmer.

In order to describe the labour structure of production in the district a "typical" farm has been selected from a sample of farms which are being investigated. Although the farm appears to be reasonably representative, there does exist a great deal of variation among farms in the area. Ideally one would want to examine the structure of a range of district farm

²⁷ See Rijks and Owen, Hydro-Meteorological records from areas of Potential Agricultural Development in Uganda, Ministry of Mineral and water resources, 1965.

²⁸ This point has been investigated in some detail and the author would discuss it further after the seminar.

²⁹ Production was regressed on sowing date, acreage, monthly rainfall, and certain of these values squared (allowing for diminishing increases). Although the total significance of mean equation was fairly good ($r^2 = .8303$) - F-values of the independent variables were rather small and partial correlation co-efficients mostly non-significant.

"types.³⁰ The use of the word "typical" here does not mean average but rather a sample farming situation which would not be abnormal when contrasted with other farm environments in the area.³¹

The farmer is John Okello who shares responsibility of the shamba with his elder father. Okello has one wife and five children the age and sex structure on the farm is:

2 men between
 2 men (16 - 45)
 1 woman (16 - 45)
 2 boys (10 - 16)
 1 girl ()
 2 young boys (under 5)

Using a work rating system based on average performance recordings over a variety of tasks, the labour availability would be:

<u>Class</u>	<u>Rating</u>	<u>Number</u>	<u>Total Rating</u>
Man (16-45)	1.00	2	2.00
Woman (16-45)	.85	1	.85
Children(10-16)	.50	3	1.50

Total labour units available: 4.35

The total available labour will be distributed not only on farm crops but also on construction, clearing, marketing and -smearing and other very necessary tasks. There will also be a certain amount of sex/task differentiation depending on the crop concerned. The adult labour will be subject to communal obligations although these same arrangements will provide labour from off the farm.

The plots on Okello's farm are small in area and most crops are grown in more than one plot. Also as has been noted above as a characteristic of the area, cotton beans, millet and peas, and cassava and groundnuts are interplanted. In the survey only 20% of the farmers grew cotton in pure stand and almost all of these had some mixed cotton also. About 80% of total millet area was mixed with peas and 50% of the cassava area with groundnuts. The latter two crops are also commonly found in pure stand.

The following table illustrates plots and crops grown in the Okello farm over a year's period.

<u>Crop.</u>	<u>Total Plots</u>	<u>Total average.</u>
Cotton	3	2.5
Beans	(in 2 Cotton plots)	2.0
Millet	3	2.0
Peas	(in 2 millet plots)	1.5
Cassava	2	.7
Groundnuts	(in one Cassava plot)	.3
Groundnuts	1	.3
Sim Sim	(followed millet in 1 plot with standing pigeon peas.	1.0
Potatoes	(2 small plots near house)	.2
	<u>Total crop acreage</u>	<u>10.5</u>
	<u>Total cropped acreage</u>	<u>6.7</u>
	<u>Cleared land area used in the year</u>	<u>5.7</u>

It is clear that inter cropping and double cropping determine what is meant by the categorical description "acreage under crops".³²

Sim Sim was planted as a second rains crop following Millet (and in the pigeon peas which were at that time standing almost shoulder height). If Sorghm had been planted (only occasionally in the area) it would most probably have also been broadcast in another of the harvested millet plots (Millet is short maturing being harvested in July). Groundnuts and Cassava also followed in a millet plot although some of each was planted separately.

In order to evaluate the extent to which this observed pattern of production placed demands on the families available labour supply, first consider the timing of labour inputs for each crop and also the amounts of labour required for a unit production (acre) during the course of the cultivation season.

The accounts for cotton, Millet, Sim Sim, Sweet Potatoes, Cassava, and Groundnuts show the relative pressures on labour (the scarce factor) which expansion of each crop would entail. It is assumed here that pigeon pea input is concomitant with that expressed for millet and as are beans with cotton. Groundnuts and Cassava are given separately and intercropped, both series must be combined.³³ (appendix 2 schedule 2)

The graph of appendix 2 schedule 2 relates the respective monthly labour inputs for the two major first rains crops cotton and millet. The labour demands of these two crops within Okello's pattern of cropping are illustrated in histogram form of purposes of preliminary visual analysis.

Millet and Cotton are the two most important crops in the system. The histogram (appendix 2 schedule 2.) demonstrates that:

1. The pattern of labour inputs of these two crops on Okello's farm is complimentary.
 - a) Peak millet labour demand is in March when cotton input is at a minimum and when the high labour demands of cotton sorting have ended (February).
 - b) As cotton labour input increases, millet requirements generally diminish. (March to August).

³⁰ Distinguished by factors such as family size availability of communal labour, capital endowment, beer brewing farms etc. This is a present being carried out.

³¹ A farm constructed strictly according to "mean" statistical values from a sample could be completely misleading and might be a quite impossible production unit in reality.

³² It would seem that used this term should be made clear in various statistics in Uganda and other parts of Africa.

³³ Where as pigeon peas and beans are much the "lesser" crops in their respective intercropping pattern - haphazardly sown - groundnuts and cassava are usually sown in regularized alternative rows.

c) The patterns are more or less "optionally" arranged since earlier millet planting in February is precluded by cotton sorting labour in that month and earlier cotton planting would place impossible labour demands for longer periods on Okello's family (also coming at period when communal watic labour is not generally available for such work). Aside from this it would jeopardize the care of millet the main food staple, a risk situation that farmers prefer to avoid.

d) Quite a bit of Millet is harvested in June and much of this early grain is immediately brewed into Pombe (beer) which buys both hired and communal labour to overcome the labour bottlenecks of cotton production which follow on immediately. This could not be available if cotton were planted earlier.

e) The analysis indicates that the Department of Agriculture's policy of encouraging earlier cotton planting (which has thus far gained little result in Northern region) has failed partly because of the interrelationship between cotton and the minor (subsistence) crop millet within the farms system of this major cotton producing zone.³⁴

Cotton production also relates to the later plantings of "minor" crops on Okello's farm. According to the farm's pattern of crop acreages the total labour requirements of crops other than millet and cotton are shown in histogram form in appendix 2 schedule 2.

The following table summarizes these requirements including Millet over the months of the cultivation year.

OKELLO: Monthly Total Labour Requirements for Crops.

Monthly labour input (pounded)

Crop	F	M	A	M	J	J	A	S	O	N	D	J
Millet(& peas)	11	106	82	49	38	39	9					
Sim Sim						20	30	42	16	20	22	
Groundnuts			9	8	5	26	22	17	27	32	12	
Cassava	1	2	14	14	34	12	25	29	28	24	11	4
Sweet potatoes			2	9	9	11	5	4	18	18		
Minor crop total without cassava	11	106	93	66	52	98	66	63	61	70	34	
Minor crop total	12	108	107	80	36	110	91	192	89	94	45	4
Cotton	84	2	45	135	152	174	151	138	110	110	169	194
Grand total without cassava	95	108	138	201	204	272	217	201	171	180	203	194
Grand total.	96	110	152	215	238	284	242	230	199	204	214	198

³⁴If I may quote the New National Plan from chapter I.
 "Problems of The Economy and the Strategy for Development."
 "Basically, the subsistence sector is a passive element in the economy. It cannot act as a stimulator of economic growth."
 p.5.

Further histograms are presented to illustrate how the above minor crops fit into the cropping schedule with regard to labour demands. A graph drawn up to show these interrelationships excludes measured cassava labour inputs. The reason for this is that cassava depends on labour input in no precise schedule. Therefore in competing with this scarce resource, the crop may be expected to absorb a residual amount of labour after the factor has been allocated to crops which require more exact inputs in more precise time intervals. It seems reasonable to assume that the farmer makes his production decisions without being greatly influenced by a given time pattern of cassava inputs.³⁵

The cumulative labour input account of time/determined minor crops is presented in Appendix 2 Schedule 4. This is contrasted with the total labour demands for cotton shown, again, in the top half of the graph. Besides holding the complementarity of labour input in the March April period (referred to before concerning millet), the heavy cotton picking labour demands of December, and January are facilitated by a low total minor crop input during that period. Thus the time of cotton planting is also intimately related to the pattern of production of second rains "minor crops". If cotton were planted early - picking labour constraints would bare down heavily on sweet potatoe, groundnut, and sim sim harvest.

On the basis of the above figures, total labour inputs on the Okello farm are graphed in appendix 2 schedule 5. Also included in this histogram is a lower graph illustrating total inputs without cassava included. Thus the "gap" between both lines represents the extent of cassava inputs over the year. February March and to a lesser extent April are slack about months. From May until January crop labour demands almost always exceeded 200 man/hours per month. Given Okello's pattern of cropping, which is typical for the area, July stands out as the month of extreme labour demand. This is the month of cotton thinning and filling gaps and the first (and very important) wedding. Additionally the millet harvest is still in progress (although finishing) and second rains crops must be planted. With regard to cassava labour inputs the total labour demand histogram shows that:

1. Like most crops Cassava requires most attention during the wet season.
2. It would seem that, during the wet season, the labour devoted to Cassava tends to smooth out the total monthly labour distribution thus indicating the farmers alternative to devote time to the crop "when he gets a chance."

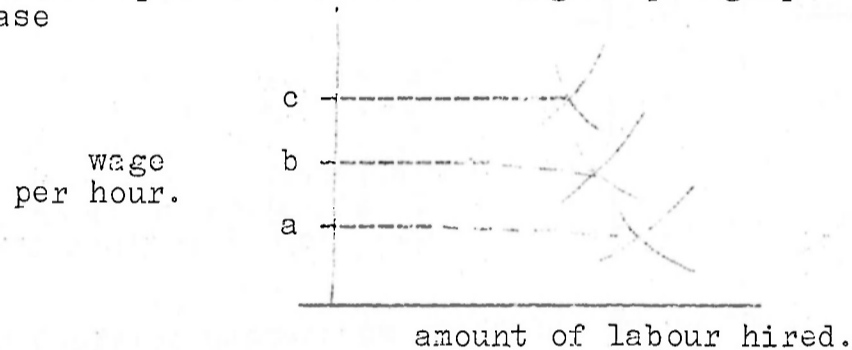
The dotted line drawn on this histogram represents the more generalized pattern of labour inputs over the season as revealed by a survey of 30 farms (an average). This more generalized pattern differs little from that of Okello's farm. It would appear that Okello cultivated slightly less millet than average and some what less cotton. His simsim acreage was greater than average and these facts should explain the discrepancies between the Okello's and the "general" pattern.

³⁵This in no way is to suggest that in other ways cassava is omitted from the decision process.

Section IV. A. A comment on the cost
Hired Labour as an alternative.

Quite a few studies, both simple and sophisticated, have been carried out on agriculture production topics which include the possible use of hired labour to overcome bottle-necks.³⁶ Usually it is assumed that the cost of a unit of hired labour remains the same throughout the cultivation season.

In Lango, as perhaps in a very many peasant agricultural circumstances, this is not the case. As may be inferred from the previous analysis, demand for hired labour is highly variable depending on time of the year. But supply is also variable. For since almost all labour is hired from local farm families, the supply tends to contract greatly during those same periods when demand is at its height. The total labour input function (dotted line=survey average) appendix schedule thus reflects both sides of the hired labour equilibrium equation. The following simple graph illustrates the case



Three basic wage equilibrium situations may be described. Wages should be expressed in shillings per hour rather than per task since the length of task varies with the relative pressure of production throughout the season.³⁷

The subscripts 1, 2, and 3 represent three periods during the season when the overall demand for labour input is at three different general levels. In period 1, (Feb. March and April) the demand for labour is relatively slack and the supply (consequently) plentiful. In period 2 (April September, October, November,), demand and supply have tightened although some labour is still on the market. Period 3 (May June Dec. Jan. July and August) is the time of maximum labour demand and minimum labour supply. The market is absolutely tight - hourly wage is high, the opportunity cost is at its apex.

Therefore the variation is (proportionately) enormous. The labour market in the three different periods is characterized not by shifts along a demand or supply curve but rather by complete changes in the level of each curve (a new "set" of functions). Three different equilibrium prices prevail depending on the period a, b, and c. Although these have not been significantly determined yet, - a rough estimate would be (depending slightly on the task) 30

³⁶It is easily and other included in programming models as an alternative activity to loosen "fixed" labour constraints.

³⁷Similar to the fact that "cups" (abit) of millet get larger for the same price (10 &) immediately following harvest.

³⁸Based on preliminary evaluation of costs in cash and kind per task and hours worked per task during various times of the year.

- a = Feb., March, =.50 cents per hour.
 b = April, Sept., Oct., Nov., =.75 per hour
 c = Jan. May June July, August = 1.10 per hour

A fuller evaluation of benefits of hired labour will be possible when correlations of yield against different types of labour (i.e. weeding, picking, etc.) has been completed. It should then be possible to put both ends together - that is to contrast hired labour cost with a statistical estimate of its marginal productivity for various crops and at different times of the year.

Section IV. B. A comment on the Substitution of Mechanized services for hand labour.

Tractor Hire Services.

There has been a very great demand for the Special Developments (Ministry Agric. Co-op.) tractor hire services in Lango and the Northern Region in general. At the end of 1965 there were 8 tractor hire services in the region. Of these, five are in Lango. In all about 40 tractors of various types were kept extremely busy at certain times of the year.³⁹

The principle use of these mechanized services has been for ploughing prior to the cotton crop. Other tasks have not been mechanized to any significant extent.⁴⁰ The greatest months of demand are late April, May, and early June. This pattern of demand for tractor ploughing of cotton fits in with the labour curves presented previously in this paper and suggests that, largely, tractors are substituting for labour within the existing structure of production (viz. crop activity dates have not shifted).

Although the demand is great - it is temporally limited, and there are other reasons why this integration of machines into the system is "limited" in profitability. Cotton plots - the largest in the traditional system - are comparatively small relative to those normally subjected to mechanical cultivation. They are scattered and often located at great distance by, bad road and path, from the hire center (a radius of 10 miles is normally the limit of such services). Cost of spares is considerable both in actual price and the loss of time waiting for repair during the peak demand season.⁴¹

In a case study in the area it has been observed that:

1. Farmers using tractor hire or Ox hire for cotton ploughing grow a considerably greater acreage of millet and cotton than is usually found.

³⁹Special Development then Report Northern Region.

⁴⁰It is estimated that about 90% of tractor hire service revenue hours in Lango derive from cotton ploughing.

⁴¹A very good coverage of some of these cost benefit points is given in Lymposium on Mechanical Cultivation in Uganda, ed. J.L. Joy.

2. These same farmers hire more labour for subsequent cotton cultivation payment being made in millet beer.

Therefore by releasing labour normally used for cotton land preparation in late April, May, and early June, farmers with the pattern of labour inputs which has been shown use this freed labour to cultivate more millet. In turn this enables them to brew more beer and thus hire more labour in kind to intensively cultivate (and harvest) the cotton crop.

Therefore mechanical cultivation has a chain effect within the traditional system. The factors which determine its profitability to the farmers (assuming it is available when they need it) are:

1. Charge per acre.
2. Increase in yield per acre.
3. Amount of hard labour displaced.
4. The degree to which 3 enables increased production of millet.
5. The price of Cotton labour for weeding and harvesting in terms of Millet.
6. The marginal benefit of this labour in terms of increased cotton yield and consequently cash.

It is noticeable that some of the economic repercussions represented by the transfer of funds through the system are not expressed in cash terms and do not normally appear in accounts. Essentially the farmer buys beer with cash, buys labour with beer, and receives cash as a result of increased labour.

Section IV. C A comment on Group Farming: A change in the System.

At the end of 1965 there were eleven group farms in the Northern Region - 4 of these were in Lango. In the area of both the survey and case study used to derive the previous information, three group farms are concentrated (Aboke, Adjetta and Inomo). As the group farming concept is the focus of the government's effort in agriculture their effect on labour input and the structure of production should be noted.

When the group farms were first started in Lango the farmers lived off the farm area and merely cultivated mechanized Cotton plots within the large fields of the farm. They paid for the mechanical cultivation services on a per acre basis and the effect on the traditional systems was much the same as has been suggested under conditions of tractor hire service. Per acre cotton yields were, on average, increased - more millet could be grown and generally the early "group farmers" were rich within the traditional system. However the demand for tractor services on the farm was limited to only few months and during the following year (1965) it was decided to plant finger millet, sorghum, groundnuts, and bullrush millet (late rains) within the group farm. During the next year the majority of farmers were moved on to the farm.

The effect of these decisions has been to radically change the agricultural system of the farmers. Although much the same crops are being grown, the pattern of labour inputs, expected yields, and extent of dealings in cash has been transformed.

A detailed analysis of the new systems and potential systems within a group farming framework is beyond the scope of this present paper. It should be noted however that at the

present level of mechanical charges to farmers on the group farms, the transformation is extremely profitable. Therefore farmers have moved onto the farms and agreed to change. Whether or not this would be the case under charging conditions reflecting "real" mechanical costs is another question.

Obligations and practices under the old system have still hindered to some extent the rapid development of group farms. Thus some farmers have been delinquent and defaulted on paying back co-operative loans for mechanical services. Farmers have also thus far refused to market crops other than cotton. However transformation is not an overnight process and, in cash and kind, group farmers are becoming much wealthier than their traditional neighbours. A detailed assesment of this transformation is being prepared for a subsequent paper.

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5. Fluctuations in cotton acreage planted.
6. Fluctuations in per acre cotton revenue
7. Distribution of rainfall contrasted with patterns of labour inputs.

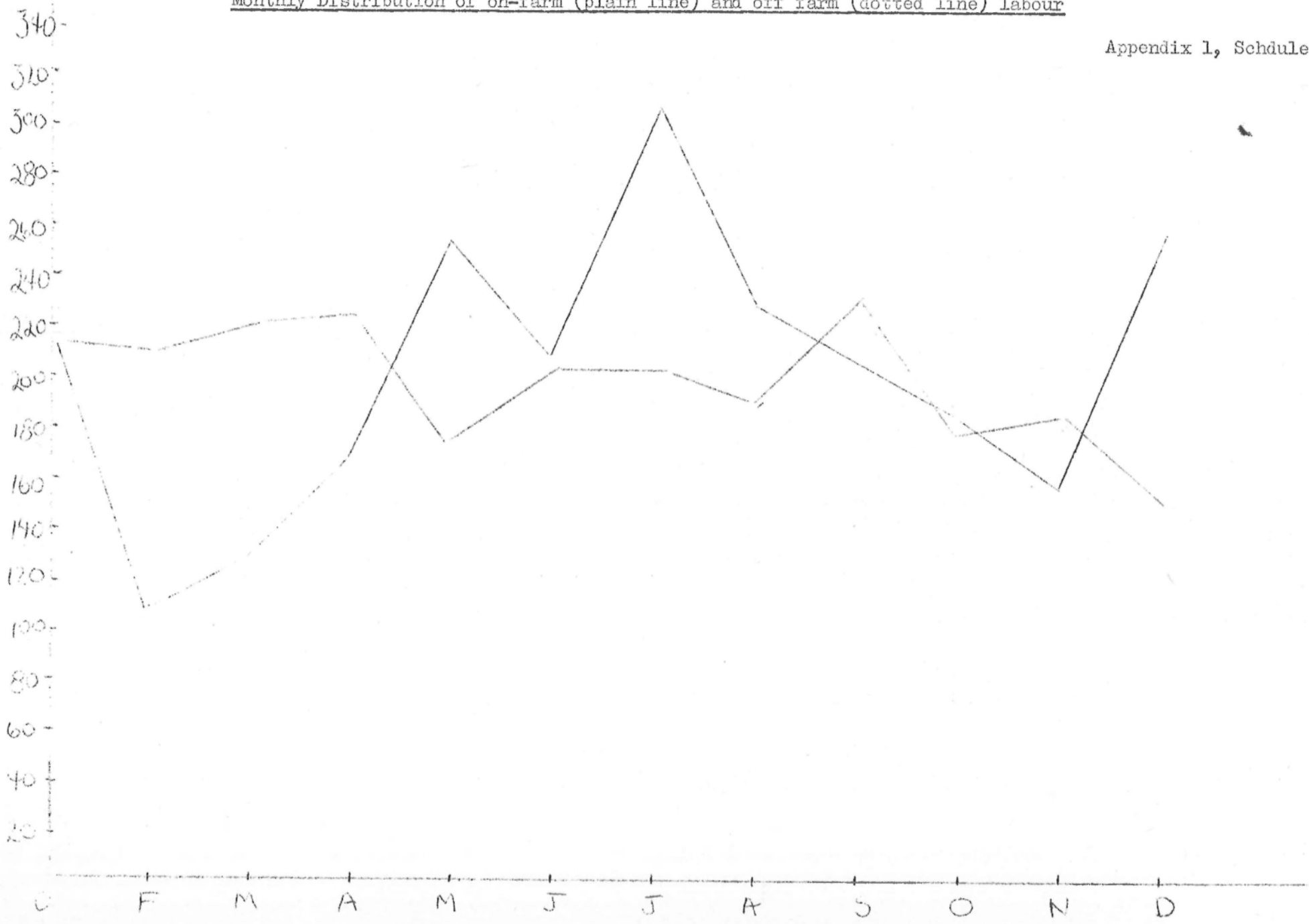
Appendix II. Lango, the Typical farm

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3. Histogram, labour requirements of minor crops.
4. Histogram, cotton labour requirements and total labour requirements of minor crops.
5. Histogram, monthly distribution of total crop labour requirements (excluding and including cassava) and over average monthly distribution over the survey.

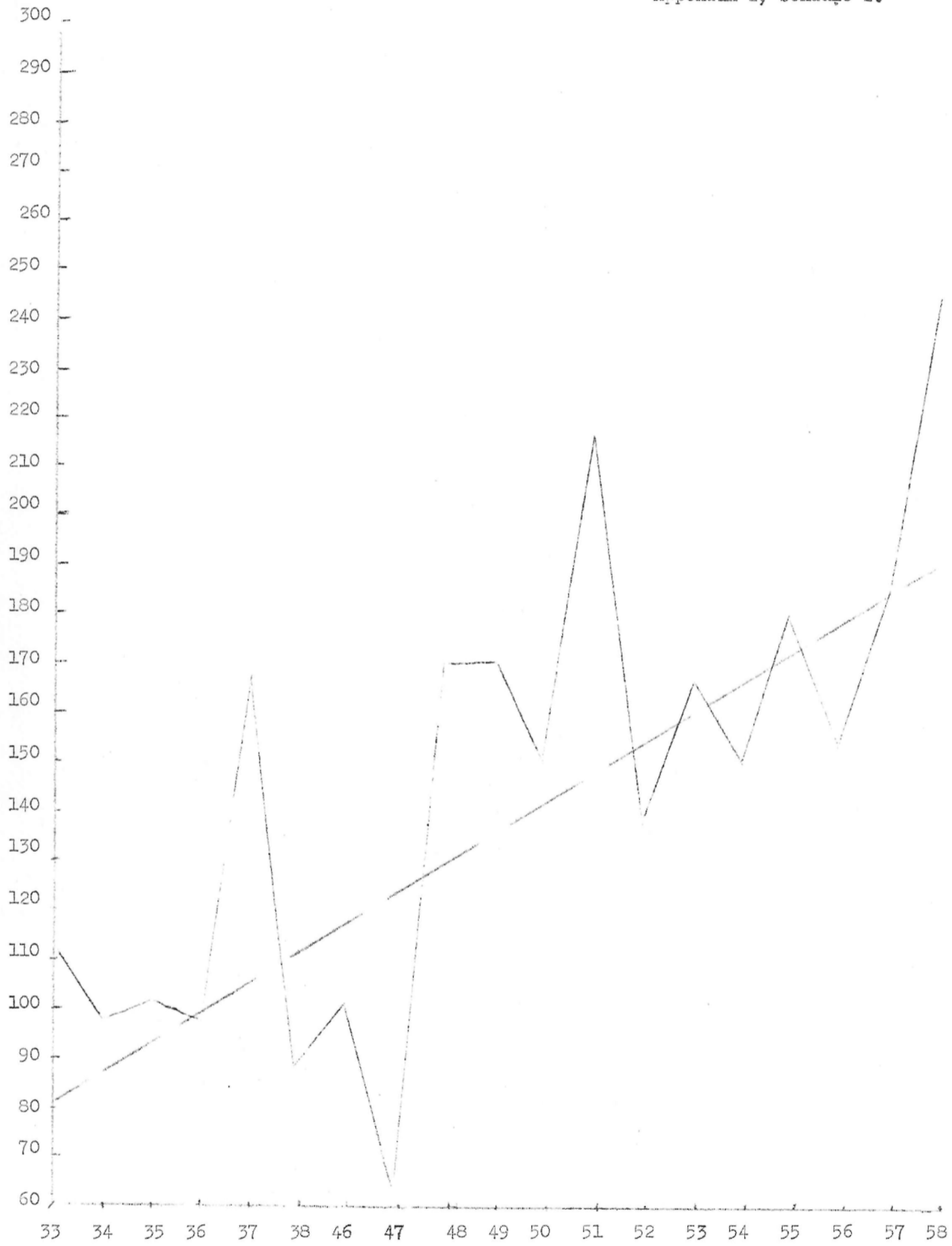
Monthly Distribution of on-farm (plain line) and off farm (dotted line) labour

Appendix 1, Schdule 1.

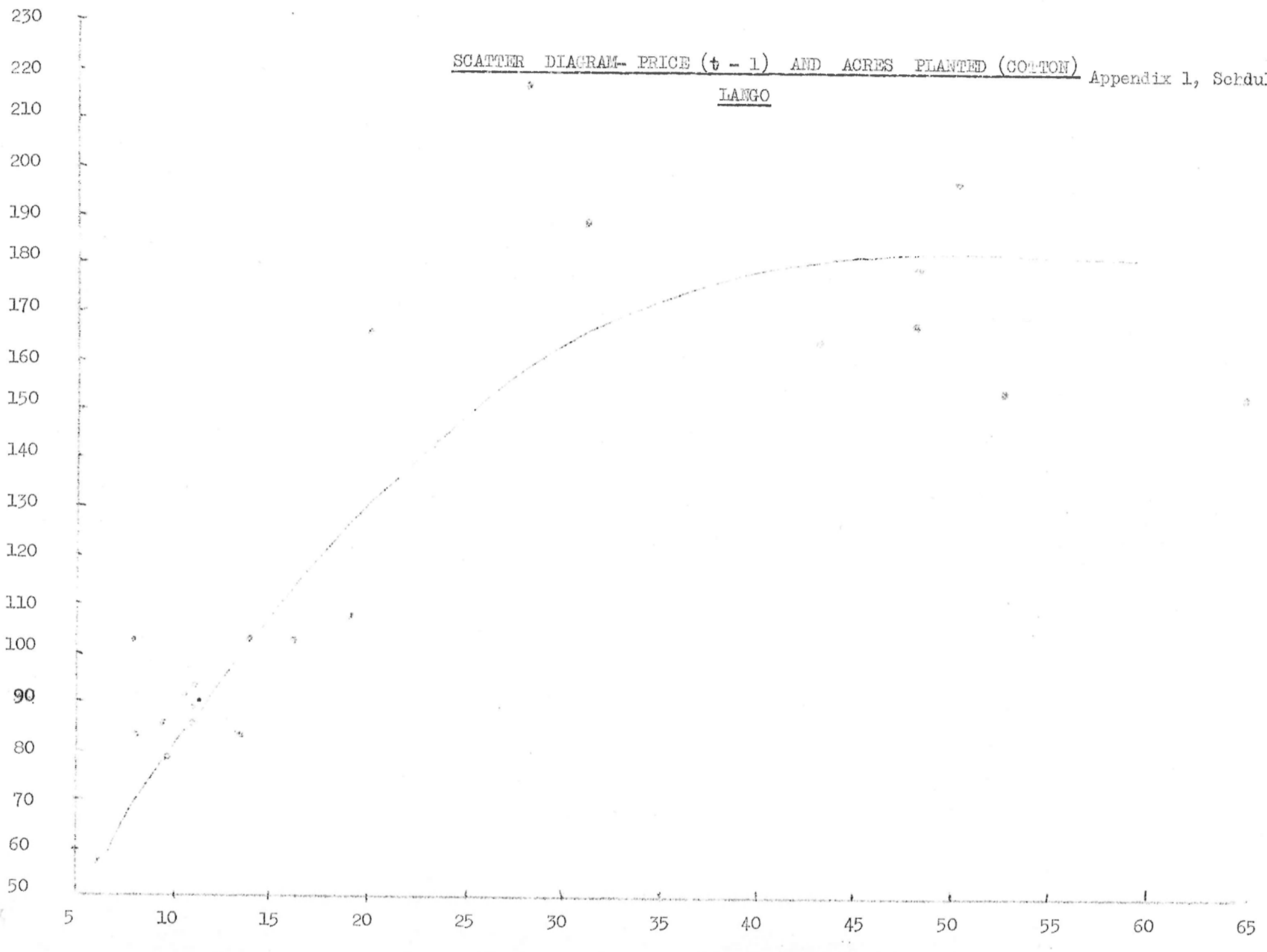


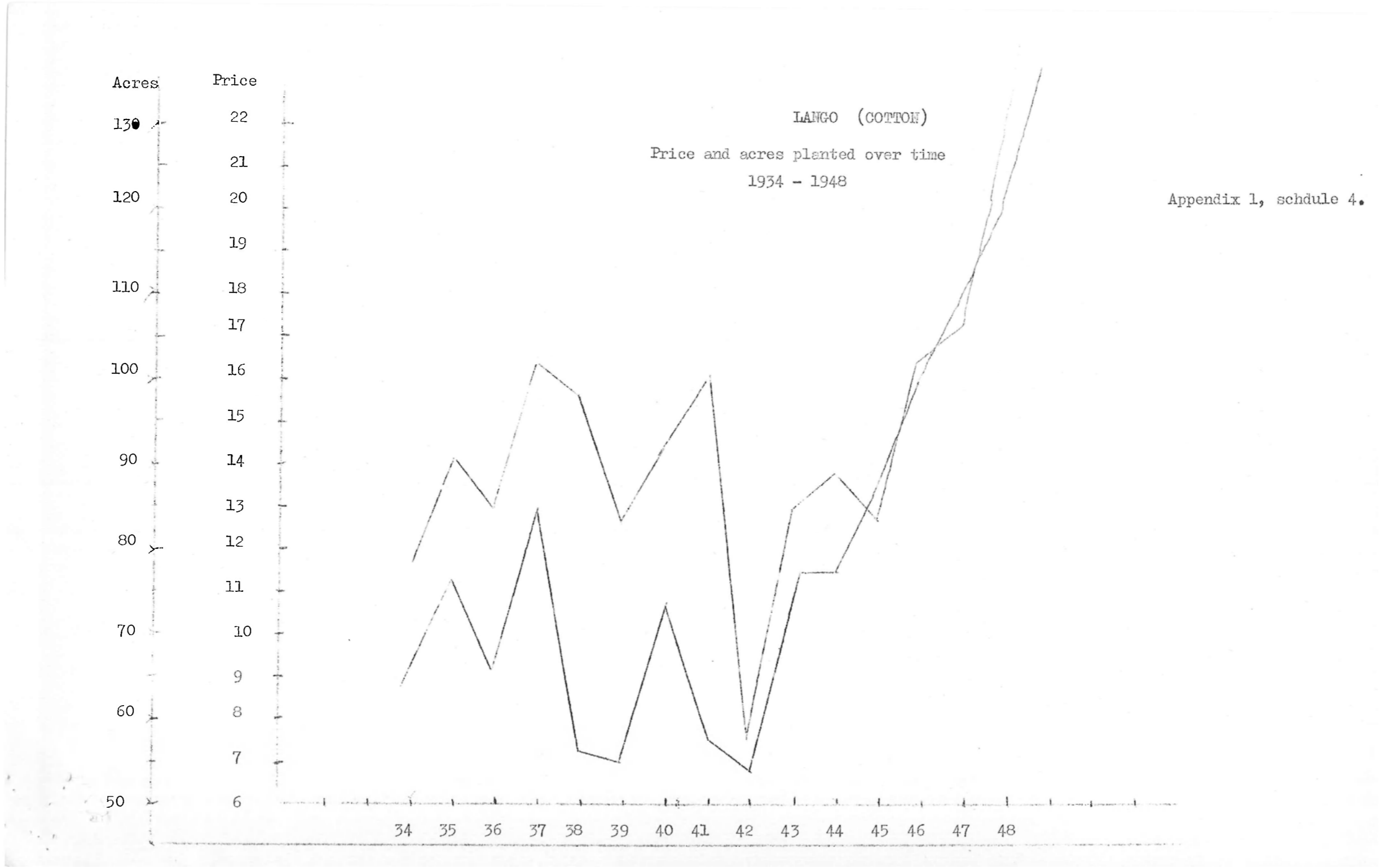
LANGO DISTRICT - TOTAL COTTON PRODUCTION TIME SERIES

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SCATTER DIAGRAM- PRICE (t - 1) AND ACRES PLANTED (COLTON) Appendix 1, Schdule 3.
LANGO

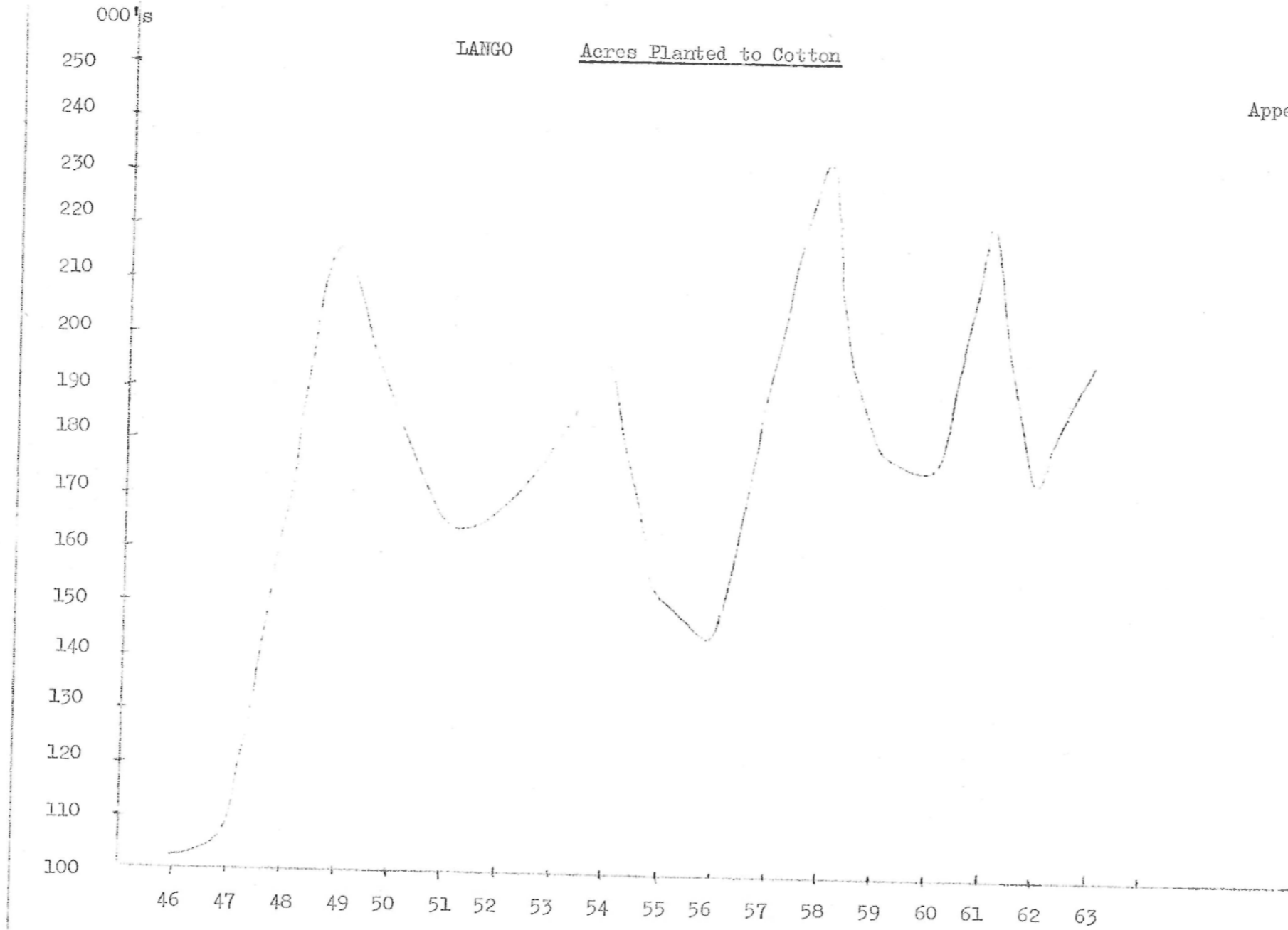


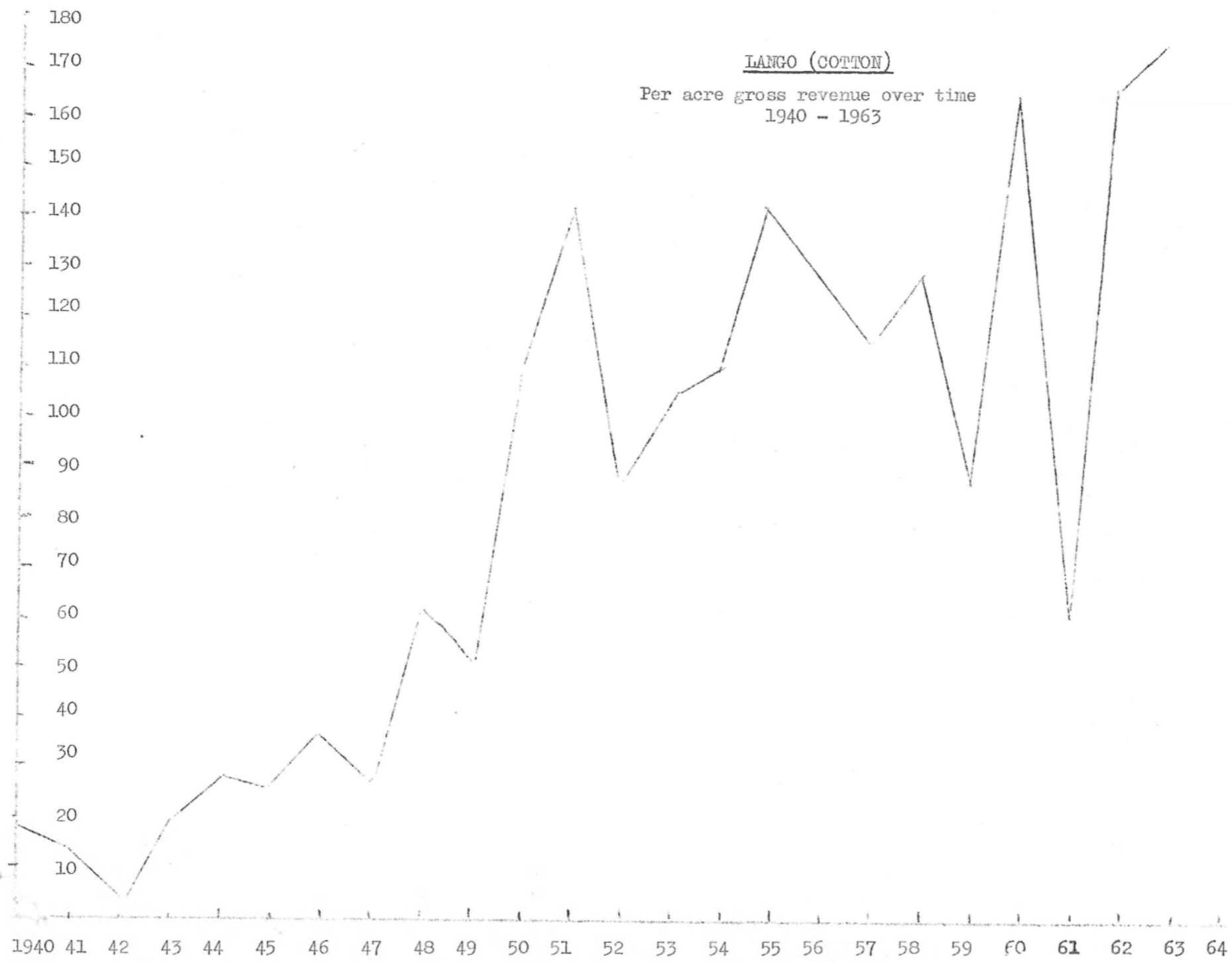


Appendix 1, schedule 4.

LANGO Acres Planted to Cotton

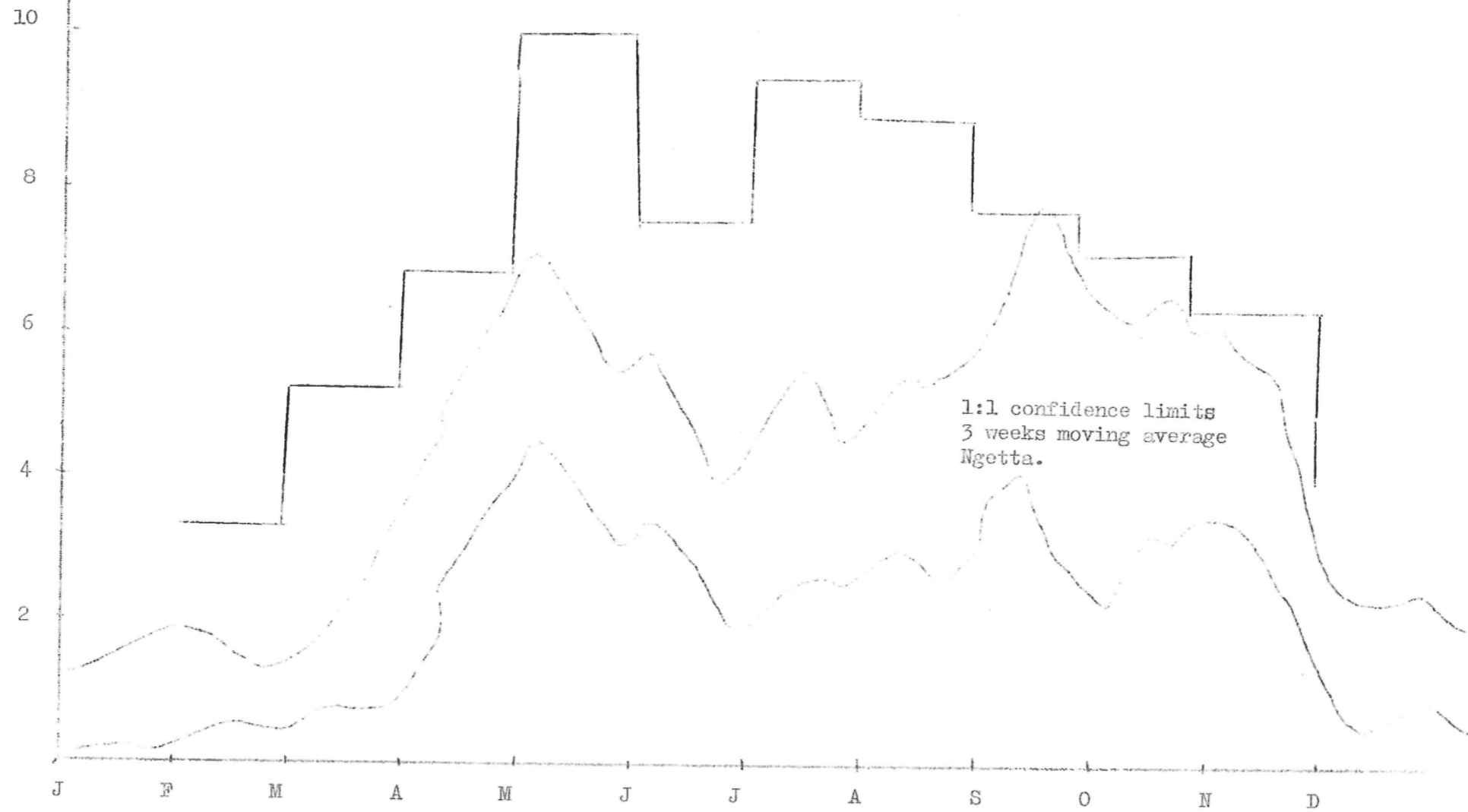
Appendix 1, Schedule 5





Appendix 1, Schedule 6.

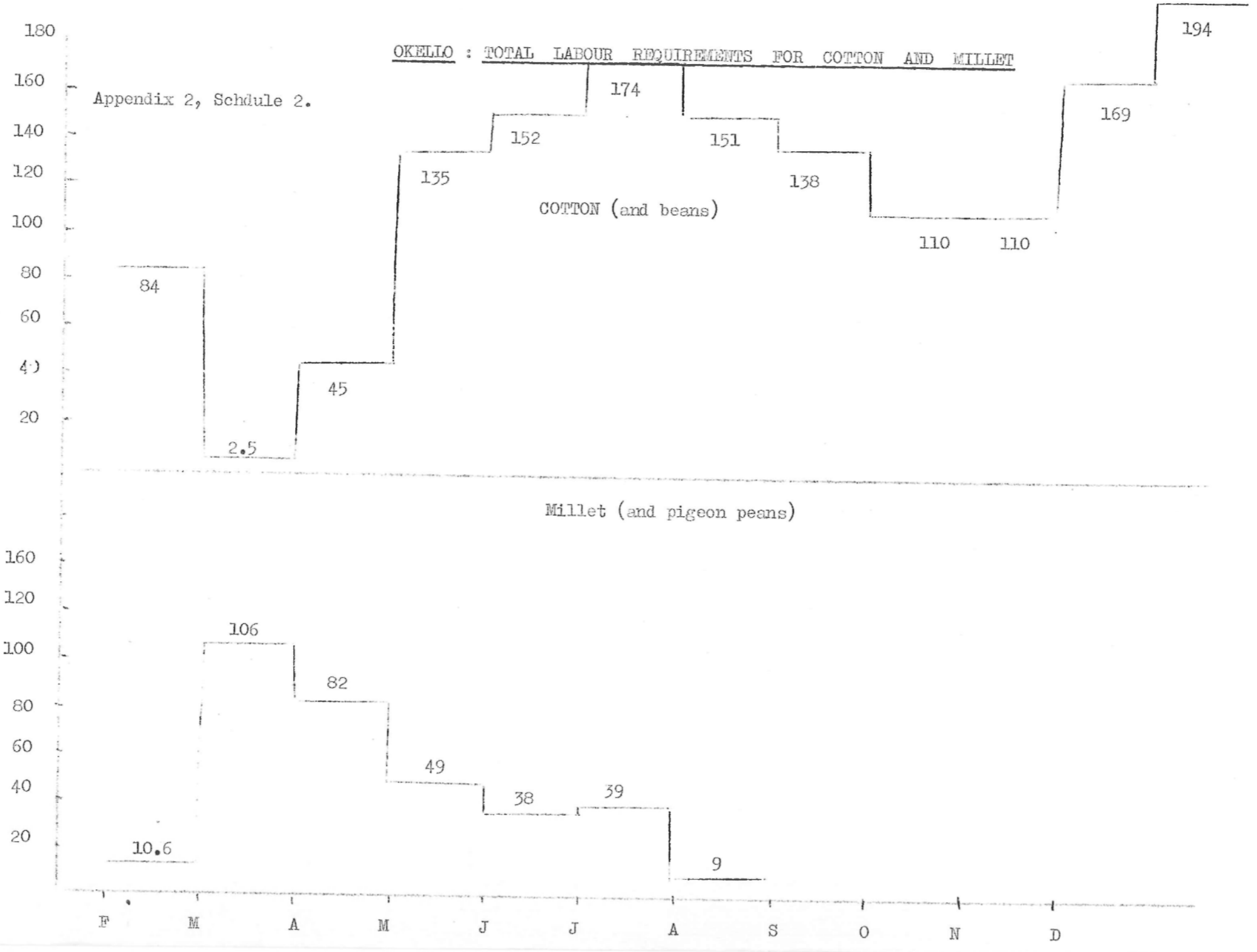
Distribution of total cultivation labour inputs (ave. 30 farms)
contrasted with distribution of rainfall confidence limits (Ngetta, Lango)



Appendix 2 Schedule I

CROP/LABOUR ACTIVITIES AND LABOUR/ACRE INPUTS DISTRIBUTED MONTHLY

	February	March	April	May	June	July	August	September	October	November	December	January
C O T T E N												
	33.7	1.0	19.1	53.9	61.6	69.4	60.6	55.4	44.0	44.0	67.4	77.8
M I L L E T												
	5.3	53.0	41.2	24.4	19.1	19.6	4.3					
S I M S I M												
				5	9	20	30	42	16	20	22	
P O T O E S												
			9.1	45.4	45.4	54.5	27.2	18.4	91.0	91.0		
CASSAVA												
	1.8	3.6	20.0	20.0	49.1	49.1	36.0	41.8	40.0	34.6	16.4	5.5
G R O N U U N T												
			(31.0)	(26.4)	(18.6)	43.5	36.1	28.4	45.0	53.5	20.0	
	Source: From analyzed accounts of 30 farms over 2 years											

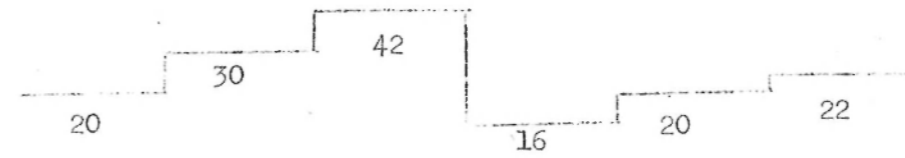


F M A M J J A S O N D J

OKELLO : TOTAL LABOUR REQUIREMENTS FOR MINOR CROPS

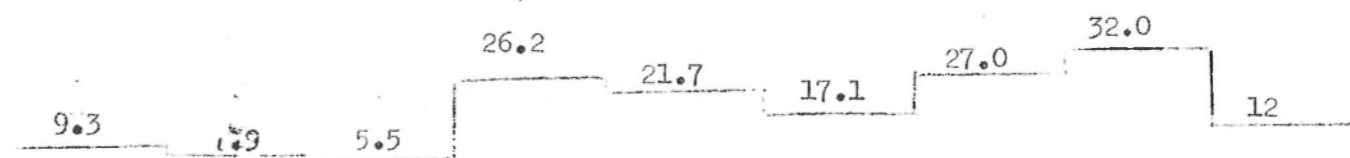
Appendix 2, schdule 3.

SIM SIM

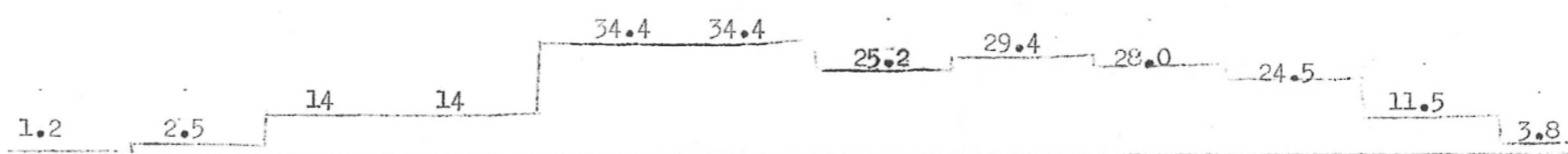


GROUNDNUTS

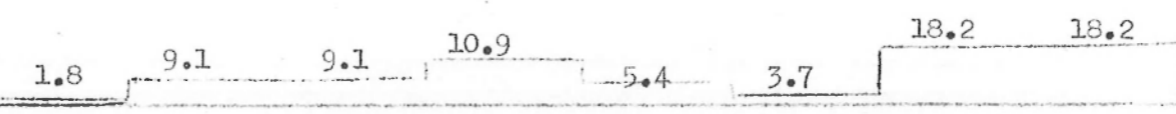
labour required to open
3 acres of groundnuts out
of the total of 6.



CASSAVA



SW. POTATOES



200

180

160

140

120

100

80

60

40

20

TOTAL COTTON LABOUR MONTHLY ALLOCATION CONTRASTED WITH MINOR CROP TOTAL

Appendix 2, Schdule 4.

COTTON

160

140

120

100

80

60

40

20

0

Millet

Potatoes and groundnuts

Sim sim

potatoes

groundnuts

F

M

A

M

J

J

A

S

O

N

J

360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20

a = monthly distribution total labour inputs, average over 30 surveyed farms
b = " " " " " Okello farm
c = " " " " " " " " excluding cassava



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