(8 31)

Makerere Institute of Social Research

EDRP No. 70
B. Van Arkadie
28/3/65

Trends in the Output of Cotton and Coffee
(Preliminary - For Discussion Purposes Only)

Prefatory Note

This short paper is very much a report on research in progress. As such, while I am quite willing to have the opinions circulated, they cannot be taken as a set of conclusions and therefore should not be quoted. The topic is an interesting diversion from the main body of work I have been doing, which arose because I was concerned with the degree to which comments on the controversial issues involved so often seem to be based on a priori reasoning rather than appeal to the evidence.

I have been able to get as far as I have entirely through the energy of Frank Bardacke, my research assistant. I have also found the comments of Derek Belshaw and E. Brett extremely helpful as they know far more about the detailed background than I do. I offer these pages in the hope of getting further help and suggestions from others.

The Problem

1. The heavy dependence of Uganda on cotton and coffee as a source of export earnings is well known. Moreover, because of the importance of exports as a source of income this has meant in the past that the overall level of economic activity has been highly dependent on the performance of these two crops. Even if diversification within agriculture and industrial development is achieved at the speed aimed at in proposed plans, the overall growth rate and expanding access to foreign exchange resources must be, for the foreseeable future, strongly influenced by the success of these two crops.

2. Evidence of the importance of these two crops is presented in Table 1. The first part of the table, (a), illustrates the degree to which Uganda exports are dependent on the two crops. The second part,(b), shows how income levels have been dependent on earnings from them.

3. From the policy viewpoint, understanding of the factors which, in the past, influenced the expansion in output of these two crops is crucial both as a guide to the

choice of correct policies and for purpose of projecting future outputs. Examples of the use of such projections for Uganda are available in paper by Clark-Van Arkadie and Van Arkadie - Ndegwa,, where assumptions are made about the growth of Uganda's agricultural output and East Africa's export earnings respectively.

4. Not only is it true that these crops are of crucial importance in the design of policy but also, within the existing institutional framework, there exit powerful instruments through which policy may be implemented. The existence of the Coffee and Cotton Marketing Boards provides a powerful mechanism for control of prices and the adjustment of growers' incomes.

5. It has become increasingly recognised that the marketing board is a multi-purpose institution in practice and in particular, that alongside such possible objectives as price or income stabilization for the particular groups of growers they may be used as taxation devices to extract forced savings from the rural sector. The importance of the crops as income sources indicates that the commodity pricing decision may be one of the crucial determinants of the pattern of income distribution.

6. Because of the multi-purpose character of the Marketing Boards a number of potential conflicts arise. Price and income stabilization may be in conflict with each other but not so inevitably as would be the case if Ugandan output levels significantly affected world prices. Stabilization objectives may also conflict with the desire to extract forced savings. There is, however, another source of conflict which must be recognised. The desire to stabilise prices or to extract surplus, may through the affect on prices paid to growers, affect the expansion of output. The possibility that the growth of supply is sensitive to prices leads to the prospect that attempts to restrain prices at the time of booms, or to extract too much surplus through the maintenance of a continuing differential between export and growers' prices, will dampen the expansion of real output. Then the use of agricultural forced savings for capital accumulation outside agriculture may reduce the rate of growth of agricultural output and thus involve a cost which should enter the calculations of the planners.

7. In the Uganda case the crude facts from which these discussions usually start are that:

(a) Uganda has failed to expand cotton outputs beyond the record season achieved in 1937-38, and

(b) although coffee output has shown substantial and continuing growth the world coffee market is such that price prospects are unfavourable and, under existing commodity agreements there is an absolute limit on the quantities of Ugandan coffee which can be sold. Although it is possible that the African countries, as the minor partners of an oligopolistic price agreement, may be able to increase their share of the world market, this is by no means automatic.

8. Some of the questions which suggest themselves are, therefore,

(a) are the supplies of coffee and cotton responsive to price enough to place important limitations on the commodity price policy?

(b) could the price mechanism be used as a means of shifting output expansion from coffee to cotton?

(c) given the poor price prospects for coffee and the poor output record for cotton can the desired expansion in cash returns be achieved?

The following comments will not answer these questions but they will present some of the evidence which would have to be used to arrive at an answer and offer some suggestions about the way the problems should be viewed.

Analysis

9. The first proposition is that there are two separate concepts of elasticity of supply which must be considered:

(a) the elasticity of supply of both crops with with respect to the level of prices, relative prices given;

(b) the cross-elasticity of supply of the two crops; that is the responsiveness of relative outputs to changes in relative prices.

10. The difficulty with analysing the elasticity of supply of the two crops with respect to changes in the level of both prices is that they form such a high proportion of the cash income opportunities in those areas where they are grown that the problem virtually resolves itself into one of the response of aggregate supply to the price level.

Viewed in this way there are two difficulties with handling the question:

(a) Time trends are likely to be dominated by overall expansion of cash crop activity; in a history of continued expansion price effects would have to be sought in an analysis of the effect on the rate of growth of outputs rather than the absolute level. Over long periods there has been an extension of cash crops into larger areas and an attraction of population into those areas (notably Buganda) in which they have been most successful. In addition, the growth in overall population continuously changes the conditions of supply by expanding labour inputs.

(b) Even when considering price response in principle, with ceteris paribus assumptions on the supply side, the problem is dominated by the by the supply of effort in response to a return for labour in a situation with few alternative income possibilities.* It is well known that in such a situation the income and substitution effects of price changes on supply are likely to be in opposition leading to the possibility of low, or even perverse, price response.

11. It is consideration of propositon 10(b) which has led many economists to suspect that price effects on supply may be neglected in considering commodity pricing, while the empirical validity of proposition 10(a) has meant that such a position is difficult to challenge. Indeed, diagram 1, which presents a three year moving average of coffee output as far back as the data is available drawn on a semi-log scale, lends some support to this view. The upward expansion of coffee would seem to have continued virtually uninterrupted, but for the Second World War, for nearly forty years. What is more surprising is that, at first sight there seems to have been no great changes in the rate of growth despite wide fluctuations in coffee prices. It must be consideration of such figures which has confirmed many obssrvers in their impressions regarding the lack of influence of price. Moreover, inspection of diagram 2, showing the growth of cotton

* Although wage opportunities, perhaps in distant places, may be a viable alternative to peasant farming. This has been suggested by Belshaw.

output, would suggest that Uganda has hit some fundamental production bottlenech at 1937-38 levels of output, implying possibly that some kind of technical transformation would be more important than any price effects.

12. Careful examination of the data, however, does suggest an explanation of output behavior which is consistent with a significant degree of sensitivity to price if the problem is framed in the correct terms. These are:

(a) that a distinction must be made between those areas of Uganda in which cotton and coffee are technically substitutable for each other and those areas suitable to cotton and not for coffee;

(b) that a model of choice between coffee and cotton be constructed which allows for the special production characteristics whichdetermine the character of rational decision making;

(c) that in applying such a model the implications of the overall expansion in output be included.

13. Predominantly, those areas in which coffee can be substituted for cotton fall in the Buganda region. There are cotton growing areas of Buganda in which coffee is not a satisfactory crop but in many of the most important agricultural areas substitution is possible. Outside Buganda cotton is largely grown in areas in which coffee cannot be produced successfully.

14. A peasant farmer, making a choice between cotton and coffee production, is faced with two kinds of costs. Current costs, consisting almost entirely of labour, consist in the case of cotton of the work of planting and picking each year, while in the case of coffee, a perrenial crop, the annual task once the bush is grown, is the less arduous one picking and caring for the mature plant. It is usually agreed that the labour involved in cotton cultivation is of a much more arduous character than that involved in coffee production. However, there is also a capital cost involved. In both cases it will be necessary to clear and prepare land for cultivation but whereas in the case of cotton the retruns come in the same season, in the case of coffee there is a waiting period of three to four years before the bush brings an income. This introduces a number of complications into the analysis.

(a) a shift from cotton to coffee in response to

price changes. may result in a drop in the current season's cotton output while coffee production will only expand after a time lag;

(b) coffee production involves capital costs in the form of waiting; to be worthwhile there must be a differential return to provide gross profit to depreciate this investment and to provide a suitable rate of return;

(c) the trees having been grown, the capital costs become history and the production from these existing trees will continue as long as the returns cover current costs (i.e. provide suitable remuneration for efforts expended on maintenance and picking).

15. Thus conceptually there are two prices which must be considered -- a "shift in price" and a "shift out price". Both of these prices are opportunity cost prices, i.e. the price of coffee in terms of cotton. To simplify the arguments the following assumptions will be made:

(i) expected future prices equal current prices, the analysis can be applied under alternative assumptions by substituting alternative measures of expected price;

(ii) differential risks in producing the crop are ignored; a risk differential could be included in a similar fashion to the effort differential,

Adopting these simplifying assumptions the two prices can be viewed in the following way:

Let: y = yield per acre of cotton (in competitive areas)

x = differential in yield required to cover additional effort required in cotton production

z = yield per acre of coffee

P_y = price of cotton (same units as y)

P_z = price of coffee (same units as z)

Then the critical price, P_o, at which cotton would replace coffee would be:

$$\text{I.} \quad P_o = \frac{P_{z_o}}{P_y} = \left(\frac{1}{x}\right)\left(\frac{y}{z}\right)$$

If P_o falls below this value producers will shift out of coffee.

In addition, there might be some small fixed cost per acre to clear coffee trees for cotton, above the usual costs of clearing land for cotton production. This would allow the price, P_c, to fall still lower before the switch is made.

To switch from cotton to coffee capital cost must be met. These capital costs may be viewed, in opportunity cost terms, in the form of foregone cotton output. That is:

Where: g = number of years for coffee to reach maturity

d = depreciation rate

r = desired rate of return desired on investment

Then the price at which producers will move into coffee, P_i, would be:

$$\text{II.} \quad P_i = \frac{P_{z_i}}{P_{y_i}} = \left(\frac{1}{x} + (d+r)g\right)\frac{y}{z}$$

Combining I and II a ratio of the two prices can be obtained:

$$\text{III.} \quad \frac{P_i}{P_o} = 1 + x(d+r)g$$

16. The size of the term $x(d+r)g$ will determine the range within which the relative price can fluctuate without switches into or out of coffee. It should be noted that three of the terms, x, d and r are, in the context of peasant farming, subjective evaluations of labour costs and returns required for postponing consumption. Further, in equation II the ratio $\frac{y}{z}$ will vary widely from those areas very favourable to coffee production to those in which it becomes a marginal crop. Therefore both P_i and $\frac{P_i}{P_o}$ will vary from farmer to farmer, with a rising level of P_i drawing in farmers with higher subjective interest rates and/or less favourable productive circumstances. Thus the model will accomodate an upward sloping supply curve for coffee in response to increases in the relative price, with a range of little or no supply response to decreases in the relative price.

17. It is interesting to speculate on the effects of in apansion of levels of income upon P_i. Increasing peasant income might be expected to:

(i) increase the utility of leisure and the disutility of unpleasant manual tasks, and therefore increase x, and

(ii) lower the subjective rate of interest, saving

being less onerous at high income levels, thus lowering r and possibly d.

Both of these effects work in the same direction in lowering P_i. Also any increase in x will lower P_o. However, the two effects will work in opposite directions on $\frac{P_i}{P_o}$ and therefore no simple conclusions can be drawn about the gap between the switching in and switching out prices. Starting from such low income levels there is a potential for substantial movements in r as a result of income increases. There is a strong possibility that shifts from cotton to coffee will continue in the absence of price movement, because of income effects. In addition the individual peasant may be faced with a capital constraint, only being able to devote a a limitied proportion of his effort to saving in each time period. The response to a price change may therefore be drawn out over long time periods, during which there will be a continuing gap between the desired coffee production capacity at that price level and the achieved capacity.

18. The final complication which must be considered is the effect of the overall expansion in output. The choice between crops is a choice of positions on an expanding production frontier. The choice of direction in which to apply additional effort may be significantly influenced by price without necessarily concentrating on one crop to the exclusion of all others. For example in areas in which and coffee are competitive, if the price is generally greater than P_o then the choice between the two crops will be made

(i) on existing cotton acreages;

(ii) on acreages representing net additions to productive capacity.

It may prove profitable to place some of the additional capacity under coffee even if no switch is being made with existing acreages. In this situation analysis of the price effect should be conceptually arrived at a comparison between an actual expansion path and an alternative path under different price conditions.

The Evidence

19. The complicated relationship implied even by the simple model above make a systematic attack on the data quite difficult. Perhaps the most serious difficulty arises

out of the nature of the lag relationships: for example the speculations above would suggest that the level of cotton output in one year should be compared with the growth of coffee output in three to four years time. Moreover the actual output figures are notoriously susceptible to fluctuations resulting from the vagaries of climate. This is especially true of cotton output. On the other hand, acreage figures, particularly outside Buganda, are seriously subject to measurement error. A complete study would make use of both types of data to achieve maximum reliability. For the moment this discussion mainly uses output data, attempting to handle climatic fluctuations through the use of moving averages.

20. Without substantiating the claims with careful econometric analysis but by applying the reasoning developed in the previous section in a rough way it will be suggested that:

(a) there is evidence of significant cross-elasticity of supply of cotton and coffee in Buganda in the sense that the level of cotton output and the rate of growth of coffee output are related to the relative prices;

(b) that if cotton output is decomposed into Buganda output (where there has been cross-elasticity) and non-Buganda output (where cotton-coffee cross-elasticity is not possible) then a quite different picture emerges of trends in cotton production than is usually derived from the overall totals.

21. Simple evidence on the sensitivity of cotton output to relative price of cotton and coffee is indicated in table VII in which the correlation of cotton output in Buganda with the price of cotton relative to coffee is shown for the pre-war and post-war periods and for the two combined. The cause of the lower coorelation in the post-war period lies in the continual decline in cotton output after the revival of the relative cotton prices at the end of the 1950's. These calculations, as they stand, are somewhat illicit as the estimate of coffee price includes the price of arabica weighted by export quantities. Insofar as little arabica is grown in Buganda this means the coffee price is not the tree price paid, deviating with fluctuations in the proportion of arabica in total exports and when arabica prices move differently from Robusta prices.

22. In the case of coffee the evidence is much less clear. However, from diagram 1 three periods of retardation in the rate of growth can be identified in the period for which price data are available (and excluding the war years 1941-1945). These are:

(i) 1937-1940, a period of slight retardation;
(ii) 1947-1953, a period of severe retardation;
(iii) 1959-1962, noticeable retardation.

Each of these is associated, with lags of 2-3 years, with periods when coffee prices were low relative to cotton. The lag cannot be taken as precisely three years because of the effects of using a three years moving average on the coffee production series. In 1954, for example, this results in pre-dating the turning point in output by one year.

23. It is interesting to note that during the period in which coffee production is experiencing slight retardation (1959-1962) cotton (1957-1960) is failing to respond to a revival in its relative price position. There are a number of possibile explanations, one of which might suggest that at the existing relative prices coffee was still preferable to cotton in expandin acreages -- the relative price had not been restored to the level of the late 1930's or late 1940's -- while there was some break on overall expansion of production. About the latter effect no evidence is offered here although in must be admitted that overall price levels were low compared with the early fifties allowing for the possibility of a general disincentive effect on effort.

24. As it stands this evidence is still only suggestive rather than conclusive. The comparison of cotton outputs in Buganda with the rest of Uganda lends support to the potential importance of such effects. This evidence is presented in table IV and diagram III. By 1950 both areas had recovered their pre-war output levels, Buganda slightly exceeding its previous achievements. Thereafter following the decline in the price of cotton relative to coffee Buganda cotton output goes into a continuous decline, partly offsetting a steady increase in output in the rest of Uganda.

25. For purposes of forecasting it is interesting to note that the negative effect of any future declines in Buganda cotton output must be limited -- ultimately output in their region cannot decline below zero (!) but even before that point cotton will be limited to those areas of Buganda in which it is not competitive with coffee. Moreover,

whereas it was once true that a 1% increase in cotton output in the rest of Uganda would be offset by a 1% decline in Buganda, by now it requires a 3% decline in Buganda's output to have that effect. If the decline in Buganda's contribution to total cotton production continues increasingly the trend in overall cotton output will be dominated by the trend in cotton output in the rest of Uganda.

26. That trend is investigated in table VIII, which fits a time trend to cotton output by regressing output on time. This is done by excluding the years 1939-1948 to exclude war effects, and numbering 1949 year 13, following on 1937-38, or year 12. The exercise is repeated, excluding 1962, a year of disasterously low output due to climate which, coming at the end of the series has an undue effect on the overall regression. The two regression coefficients suggest rates of growth of 4.4% and 5.3% per annum respectively. Simple extrapolation of past trends, particularly when there is some signs of retardation, is not a useful way of forecasting. However, this evidence does provide a much more optimistic prospect for future expansion thatn the overall figures would suggest.

Policy Implications

27. This analysis is still too fragmentary to offer any firm implication for policy. For purposes of discussion, however, the following points are raised:

(i) the potentiality of peasant sensitivity to relative prices must be taken seriously in deciding commodity price policy;

(ii) that in the past relative cotton and coffee prices have had considerable consequences for the changing pattern of Buganda output, but that

(iii) this effect is substantially non-reversible at least in the medium run within the likely range of relative prices; therefore the particular problem discussed at length here has less relevance in considering future policy than in evaluating past performance;

(iv) insofar as the shift has now been made into coffee, and cotton is increasingly grown in areas without coffee potential, cross-elasticity between these two crops will diminish

overall, although the cross-elasticity of cotton with other crops or income alternatives may be important;

and finally

(v) it is interesting to note that the relative prices of cotton and coffee have become of increasing significance as a determinant of the income of Buganda relative to the rest of Uganda as Buganda has increasingly specialized in coffee, and cotton in the rest of Uganda has expanded.

Table I

A.	Total Exports £' 000	Cotton Export Value £' 000	Cotton % of T.E.	Coffee Export Value £' 000	Coffee % of T.E.
1954	40,575	20,877	51.5	13,478	33.2
1955	41,902	16,386	39.1	20,134	48.0
1956	40,418	19,285	47.7	15,721	38.9
1957	45,857	17,476	38.1	21,587	47.1
1958	45,409	18,141	39.9	20,827	45.9
1959	42,091	15,428	36.7	18,688	44.4
1960	41,588	14,930	35.9	16,987	40.9
1961	39,195	16,716	42.6	13,979	35.7
1962	37,635	8,260	21.9	20,174	53.6
1963	51,475	14,330	27.8	27,181	52.8

B.	Monetary G.D.P. £' 000	Cotton & Coffee Value £' 000	Cotton & Coffee % of GDP
1954	92,760	34,355	37.0
1955	101,990	36,520	35.8
1956	102,778	35,006	34.1
1957	109,375	39,063	35.7
1958	105,931	38,968	36.8
1959	107,982	34,116	31.6
1960	110,815	31,917	28.8
1961	111,170	30,695	27.6
1962	107,928	28,434	26.3
*1963	128,704	41,511	32.3

* Provisional

Sources: Statistical Abstracts, 1958, 1964.
Real Growth of the Economy of Uganda, 1954-1962.

Table II

Coffee Export and Production

	3 Year Moving Average '000 Tons	% Change	Absolute Change	Cotton/Coffee Price
1924				6.61
1925	1.73			5.20
1926	1.78	2.89	+ .05	3.76
1927	1.95	9.55	+ .17	3.28
1928	2.08	6.67	+ .13	4.37
1929	2.17	4.33	+ .09	3.77
1930	2.67	23.04	+ .50	3.75
1931	3.43	28.46	+ .76	3.48
1932	4.28	24.78	+ .85	2.92
1933	5.69	32.94	+ 1.41	4.33
1934	6.34	11.42	+ .65	5.42
1935	8.49	33.91	+ 2.15	6.17
1936	10.22	20.38	+ 1.73	6.12
1937	12.79	25.15	+ 2.57	7.88
1938	14.67	14.70	+ 1.88	7.08
1939	16.09	9.68	+ 1.42	6.23
1940	17.90	11.25	+ 1.81	8.86
1941	16.30			7.73
1942	17.30	6.13	+ 1.00	5.76
1943	15.30		0	9.10
1944	15.30		0	9.50
1945	17.30		+ 2.00	9.17
1946	19.00	9.83	+ 1.70	8.86
1947	24.00	26.31	+ 5.00	6.11
1948	22.00		0	5.35
1949	25.00	4.17	+ 1.00	6.86
1950	26.30	5.20	+ 1.30	5.58
1951	30.30	15.21	+ 4.00	5.87
1952	30.70	1.32	+ .40	4.21
1953	27.30		0	2.97
1954	37.30	21.50	+ 6.60	2.01
1955	44.30	18.77	+ 7.00	2.93
1956	56.70	27.99	+12.40	3.49
1957	58.30	2.82	+ 1.60	4.05
1958	73.30	25.73	+15.00	3.91
1959	88.30	20.46	+15.00	3.79
1960	94.30	6.80	+ 6.00	4.44
1961	98.00	3.92	+ 3.70	
1962	109.30	11.53	+11.30	

Notes: 1925-1940 - Total Uganda Coffee Export.
1941-1962 - African Robusta coffee production, including small amounts of Arabica not grown in the Bugisu scheme.

Sources: 1924-1928; Ag. Report 1928, p. 58.
1929-1937, Wrigley, p. 61.
1938-1940, Ag. Report 1944, pp. 42-42.
1941-1962, Uganda Statistical Abstracts, 1957 & 1962.

(column 4 - see tables V and Va)

Table III

Uganda Cotton Production

	400 lb. Bales '000	'000 Bales (3 Year Average)	
1907	2		
1908	4	3.67	
1909	5	7.00	
1910	12	12.33	
1911	20	19.33	
1912-13	26	28.67	Years from 1912-13
1913-14	40	30.67	refer to picking
1914-15	26	29.33	season which begins
1915-16	22	25.33	in the end of the
1916-17	28	25.67	first year mentioned
1917-18	27	30.33	and ends in the be-
1918-19	36	36.67	ginning of the sub-
1919-20	47	54.67	sequent year.
1920-21	81	58.67	
1921-22	48	72.33	
1922-23	88	88.00	
1923-24	128	137.33	
1924-25	196	168.00	
1925-26	180	170.00	
1926-27	134	150.67	
1927-28	138	158.67	
1928-29	204	155.67	
1929-30	125	172.67	
1930-31	189	173.67	
1931-32	207	230.33	
1932-33	295	262.67	
1933-34	286	278.00	
1934-35	253	285.00	
1935-36	316	300.33	
1936-37	332	355.33	
1937-38	418	352.33	
1938-39	307	341.67	
1939-40	300	324.00	
1940-41	365	301.00	
1941-42	238	238.33	
1942-43	112	180.33	
1943-44	191	191.67	
1944-45	272	230.00	
1945-46	227	243.33	
1946-47	231	209.33	
1947-48	170	264.00	
1948-49	391	300.00	
1949-50	339	358.67	
1950-51	346	355.00	
1951-52	380	348.67	
1952-53	320	366.00	
1953-54	398	339.33	
1954-55	300	354.00	
1955-56	364	345.33	
1956-57	372	362.33	
1957-58	351	374.67	
1958-59	401	370.67	
1959-60	360	377.33	
1960-61	371	304.00	
1961-62	181		

Sources: (1) columns 1, 2, & 3 (1952-62) AG. Report 1962, p. 51, p. 4.

Table IV

Buganda African Cotton Production

	Prod. '000 Bales	3 Year Average of (1)	Non-Buganda Bales '000	3 Year Average of (3)	Buganda as % of Total
1926-27	49.3		84.7		36.8
1927-28	66.8	66.6	71.2	92.1	48.4
1928-29	83.7	72.0	120.3	83.7	41.0
1929-30	65.4	68.6	59.6	104.0	52.3
1930-31	56.8	66.8	132.2	106.9	30.1
1931-32	78.2	84.9	128.8	145.4	37.8
1932-33	119.8	103.0	175.2	159.7	40.6
1933-34	110.9	119.9	175.1	158.1	38.8
1934-35	128.9	128.3	124.1	156.7	50.9
1935-36	145.0	141.1	171.0	159.0	45.9
1936-37	150.2	157.8	181.8	197.6	45.2
1937-38	178.1		239.9		42.6
1943-44	93.3		97.7		48.8
1944-45	128.6	118.2	143.4	111.8	47.3
1946	132.7	125.6	94.3	118.7	58.5
1947	112.5	107.1	118.5	102.2	48.7
1948	76.2	123.0	93.8	141.0	44.8
1949	180.2	139.9	210.8	160.1	46.1
1950	163.3	163.1	175.7	195.6	48.2
1951	145.8	146.0	200.2	209.0	42.1
1952	128.9	125.4	251.1	223.3	33.9
1953	101.4	121.8	218.6	244.2	31.7
1954	135.0	111.5	263.0	227.9	33.9
1955	98.0	112.8	202.0	241.2	32.7
1956	105.5	106.0	258.5	239.4	29.0
1957	114.4	106.3	257.6	256.1	30.8
1958	98.9	105.1	252.1	269.5	28.2
1959	102.1	96.9	298.9	273.8	25.5
1960	89.7	87.1	270.3	290.2	24.9
1961	69.6	70.7	301.4	233.3	18.8
1962	52.7		128.3		29.1

Notes: 1946 corresponds to picking season 1945-46, 1947 corresponds to picking season 1946-47. etc.

Sources: Column (1) -
1926-28, Annual Report of the Dept. of Agric., 1928, p. 7.
1928-29, Annual Report of the Dept. of Agric., 1929, p. 6.
1929-30, " " " " " " " , 1930, p. 7.
1930-31, " " " " " " " , 1931, p. 8.
1931-32, " " " " " " " , 1932, p. 6.
1932-33, " " " " " " " , 1933, p. 6.

Table IV Sources (continued)

Column 1 (continued)

1933-34, Annual Report of the Dept. of Agric., 1934; p. 6.
1934-35, " " " " " " " , 1935, p. 4.
1935-36, " " " " " " " , 1936, p. 4.
1936-37, " " " " " " " , 1937, p. 4.
1937-38, " " " " " " " , 1938, p. 5.

1943-45, " " " " " " " , 1945; p. 40.
1946, " " " " " " " , 1946, p. 38.
1947; " " " " " " " , 1947, p. 56.
1948; " " " " " " " , 1948; p. 35.
1949; " " " " " " " , 1949, p. 37.
1950, " " " " " " " , 1950, p. 42.
1951, " " " " " " " , 1951, p. 44.
1952; " " " " " " " , 1952, p. 61.
1953, " " " " " " " , 1953, p. 100.
1954; " " " " " " " , 1954, p. 131.
1955; " " " " " " " , 1955, p. 27.
1956, " " " " " " " , 1956, p. 52.
1957, " " " " " " " , 1957, p. 46.
1958; " " " " " " " , 1958, p. 57-8.
1959; " " " " " " " , 1959, p. 45-6.
1960, " " " " " " " , 1960, p. 41-2.
1961, " " " " " " " , 1961, p. 11-2.

Column 3 = Column (1) of table III - Column (1)

Table V

Coffee and Cotton Prices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1946		70.9			8.86		
1947	45.6	51.4	88.7	80.5	7.59	6.11	
1948	32.2	54.3	59.3	53.8	9.95	5.35	6.11
1949	42.5	41.7	101.9	92.5	7.42	6.86	5.93
1950	45.0	26.8	167.9	152.5	3.66	5.58	6.10
1951	36.1	29.7	121.5	110.3	5.32	5.86	5.22
1952	39.6	43.4	91.2	82.8	5.08	4.20	4.35
1953	64.4	61.0	105.6	95.9	3.10	2.97	3.06
1954	61.4	76.1	80.7	73.3	2.74	2.00	2.64
1955	73.5	90.2	81.5	74.0	3.96	2.93	2.81
1956	67.4	70.2	96.0	87.2	4.00	3.48	3.49
1957	67.8	61.6	110.1	100.0	4.05	4.05	3.82
1958	77.8	63.5	122.5	111.2	3.52	3.91	3.92
1959	70.7	66.1	107.0	97.2	3.90	3.79	4.05
1960	64.6	82.9	77.9	70.7	6.28	4.44	4.60
1961	70.6	81.4	86.7	78.7	7.06	5.55	5.02
1962	73.6	78.4	93.9	85.3	5.95	5.07	

(1) = $\frac{\text{Cotton Producer Price}}{\text{Cotton Export Price}}$

(2) = $\frac{\text{Coffee African Producer Price}}{\text{Coffee Export Price}}$

(3) = $\frac{\text{Column (1)}}{\text{Column (2)}}$

(4) = Column (3) adjusted with 1957 taken as 100

(5) = $\frac{\text{Cotton Export Price}}{\text{Coffee Export Price}}$

(6) = Adjusted Relative Price (Column (4) x Column (5))

(7) = Three year moving average of Adjusted Relative Price

Notes: The post-war prices received by farmers for cotton and coffee were affected by export taxes and surplus of marketing boards. To adjust for this it was necessary to derive an index to adjust for the differential effects of these two elements. This was done by using 1957 as a base, for in that year (the 1956-57 season) the net effect of tax and surplus was negligible.

(1) Source for producer price: Agricultural Report 1962, p. 51
Uganda Stat. Abst. 1958, 1964
Producer price was determined by dividing production by value to grower.

(1) Source for export price: Ehrlich, Uganda Co. Ltd., p. 56-7
Uganda Stat. Abst. 1956, 1963
Export price was determined by dividing quantity by export value.

(2) Source for producer price: Uganda Stat. Abst. 1957, 1962
Producer price was determined by dividing sales of robusta by value to grower of robusta.

(2) Source for export price: Agricultural Report 1948
Uganda Stat. Abst. 1957, 1963
Export price was determined by dividing total coffee export quantity by total export value.

Table VI

	(1)	(2)
1924	6.61	
1925	5.20	5.19
1926	3.76	4.08
1927	3.28	3.80
1928	4.37	3.81
1929	3.77	3.96
1930	3.75	3.67
1931	3.48	3.38
1932	2.92	3.58
1933	4.33	4.22
1934	5.42	5.31
1935	6.17	5.90
1936	6.12	6.72
1937	7.88	7.03
1938	7.08	7.06
1939	6.23	7.39
1940	8.86	7.61
1941	7.73	7.45
1942	5.76	7.53
1943	9.10	8.12
1944	9.50	9.26
1945	9.17	9.18
1946	8.86	8.54
1947	7.59	8.80
1948	9.95	8.32
1949	7.42	7.01
1950	3.66	5.47
1951	5.32	4.69
1952	5.08	4.50
1953	3.10	3.64
1954	2.74	3.27
1955	3.96	3.57
1956	4.00	4.00
1957	4.05	3.86
1958	3.52	3.82
1959	3.90	4.57
1960	6.28	5.75
1961	7.06	6.43
1962	5.95	

Column (1) = $\frac{\text{Cotton Export Price}}{\text{Coffee Export Price}}$

Column (2) = Three year moving average of column (1)

(1) Source for cotton export price the same as Table V.
Price devised by the same method as Table V.

(1) Source for Coffee Export Price:

For 1924-28, Agricultural Report 1928, p. 58.
For 1929-37; Wrigley, p. 61.
For 1938-44, Agricultural Report 1944, p. 42-3.

For the remaining years source the same as Table V.
Price devised by the same method as Table V.

TABLE VII

Year	1	year	2	r 1 & 2	t 1 & 2	Significance of t	1-1A&2-2A	1-1A&2-2A	Significance of t
1928	66.6	1927	3.28	.8093	3.897	.5%	.6613	4.135	.1%
1929	72.0	1928	4.37						
1930	68.6	1929	3.77						
1931	66.8	1930	3.75						
1932	84.9	1931	3.48						
1933	103.0	1932	2.92						
1934	119.9	1933	4.33						
1935	128.3	1934	5.42						
1936	141.4	1935	6.17						
1937	157.8	1936	6.12						
				r	t				
	1A		2A	1A&2A	1A&2A				
1947	107.1			.6152	2.703	2%			
1948	123.0	1947	6.11						
1949	139.9	1948	5.35						
1950	163.1	1949	6.86						
1951	146.0	1950	5.58						
1952	125.4	1951	5.87						
1953	121.8	1952	4.21						
1954	111.5	1953	2.97						
1955	112.8	1954	2.01						
1956	106.0	1955	2.93						
1957	106.3	1956	3.49						
1958	105.1	1957	4.05						
1959	96.9	1958	3.91						
1960	87.1	1959	3.79						
1961	70.7	1960	4.44						

TABLE VIIa

Year	1	Year	3	r 1&3	t 1&3	Signi-ficance of t	r 1-1A&3-3A	t 1-1A&3-3A	Signi-ficance of t
1928	66.6	1928	4.37	.9115	6.268	.1%	.5733	3.282	.5%
1929	72.0	1929	3.77						
1930	68.6	1930	3.75						
1931	66.8	1931	3.48						
1932	84.9	1932	2.92						
1933	103.0	1933	4.33						
1934	119.9	1934	5.42						
1935	128.3	1935	6.17						
1936	141.4	1936	6.12						
1937	157.8	1937	7.88						
	1A		3A	r 1A&3A	t 1A&3A				
1947	107.1	1947	6.11	.3499	1.293	25%			
1948	123.0	1948	5.35						
1949	139.9	1949	6.86						
1950	163.1	1950	5.58						
1951	146.0	1951	5.87						
1952	125.4	1952	4.21						
1953	121.8	1953	2.97						
1954	111.5	1954	2.01						
1955	112.8	1955	2.93						
1956	106.0	1956	3.49						
1957	106.3	1957	4.05						
1958	105.1	1958	3.91						
1959	96.9	1959	3.79						
1960	87.1	1960	4.44						
1961	70.7	1961	5.56						

TABLE VIIb

Year	1	Year	4	r 1&4	t 1&4	Signi-ficance of t	1-1A&4-4A	1-1A-4-4A	Signi-ficance of t
1928	66.6	1928	3.81	.9644	10.315	.1%	.6305	3.810	.1%
1929	72.0	1929	3.96						
1930	68.6	1930	3.67						
1931	66.8	1931	3.38						
1932	84.9	1932	3.58						
1933	103.0	1933	4.22						
1934	119.9	1934	5.31						
1935	128.3	1935	5.90						
1936	141.4	1936	6.72						
1937	157.8	1937	7.03						
	1A		4A	1A&4A	1A&4A				
1947	107.1			.4089	1.552	20%			
1948	123.0	1948	6.11						
1949	139.9	1949	5.93						
1950	163.1	1950	6.10						
1951	146.0	1951	5.22						
1952	125.4	1952	4.35						
1953	121.8	1953	3.06						
1954	111.5	1954	2.64						
1955	112.8	1955	2.81						
1956	106.0	1956	3.49						
1957	106.3	1957	3.82						
1958	105.1	1958	3.92						
1959	96.9	1959	4.05						
1960	87.1	1960	4.60						
1961	70.7	1961	5.02						

TABLE VIIc

Year	1	Year	5	1&5	1&5	Significance of t	1-1A&5-5A	1-1A&5-5A	Significance of t
1928	66.6	1927	3.80	.8762	5.142	.1%	.5995	3.432	.5%
1929	72.0	1928	3.81						
1930	68.6	1929	3.96						
1931	66.8	1930	3.67						
1932	84.9	1931	3.38						
1933	103.0	1932	3.58						
1934	119.9	1933	4.22						
1935	128.3	1934	5.31						
1936	141.4	1935	5.90						
1937	157.8	1936	6.72						
	1A		5A	1A&5A	1A&5A	Significance of t			
1947	107.1			.4272	1.567	20%			
1948	123.0								
1949	139.9	1948	6.11						
1950	163.1	1949	5.93						
1951	146.0	1950	6.10						
1952	125.4	1951	5.22						
1953	121.8	1952	4.35						
1954	111.5	1953	3.06						
1955	112.8	1954	2.64						
1956	106.0	1955	2.81						
1957	106.3	1956	3.49						
1958	105.1	1957	3.82						
1959	96.9	1958	3.92						
1960	87.1	1959	4.05						
1961	70.7	1960	4.60						

Notes to Table VII, VIIa, VIIb, VIIc.

1. = three year moving average of Buganda cotton output in '000 Bales.

Source: Same as Col.2 Table IV.

2. = $\frac{\text{Cotton Export Price}}{\text{Coffee Export Price}}$ Source: Same as Col.1 Table VI

3 = Same as 2 But no Lag.

4 = Three year average $\frac{\text{Cotton Export Price}}{\text{Coffee Export Price}}$ Source: Same as Col. 2 Table VI.

5 = Same as 4 But lagged one year.

TABLE VIII

Rest of Uganda Cotton, Regression Results.

		Annual increase	r^2	Standard Error Estimate
1.	$\text{Log}_e y = 5.17 + .022x$ (.01)	4.490	.595 (.01)	.272
2.	$\text{Log}_e y = 5.18 + .0526X$ (.01)	5.390	(.01)	.211

y = Cotton production, '000 Bales

x = 1926-27 - 1937-38, 1948-49 - 1961-62 (x=1...26)

X'= 1926-27 - 1937-38, 1948-49 - 1960-61 (x'=1....25)

(Significance Level Shown in parenthesis below time parameter and R^2).

DIAGRAM I

GROWTH OF COFFEE EXPORT AND PRODUCTION
THREE YEAR MOVING AVERAGE

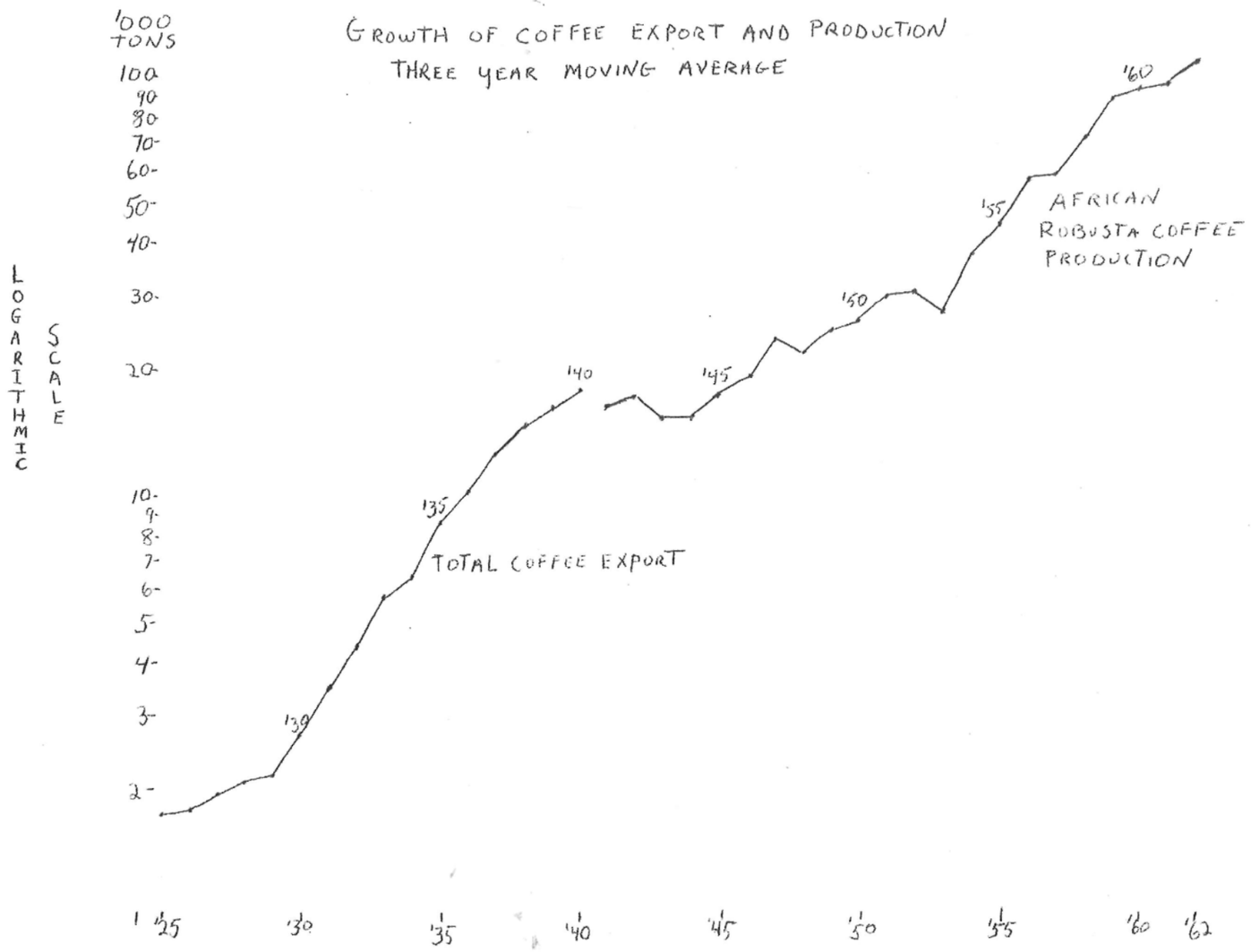


DIAGRAM II

Three Yr Moving Average Of Uganda Cotton Production

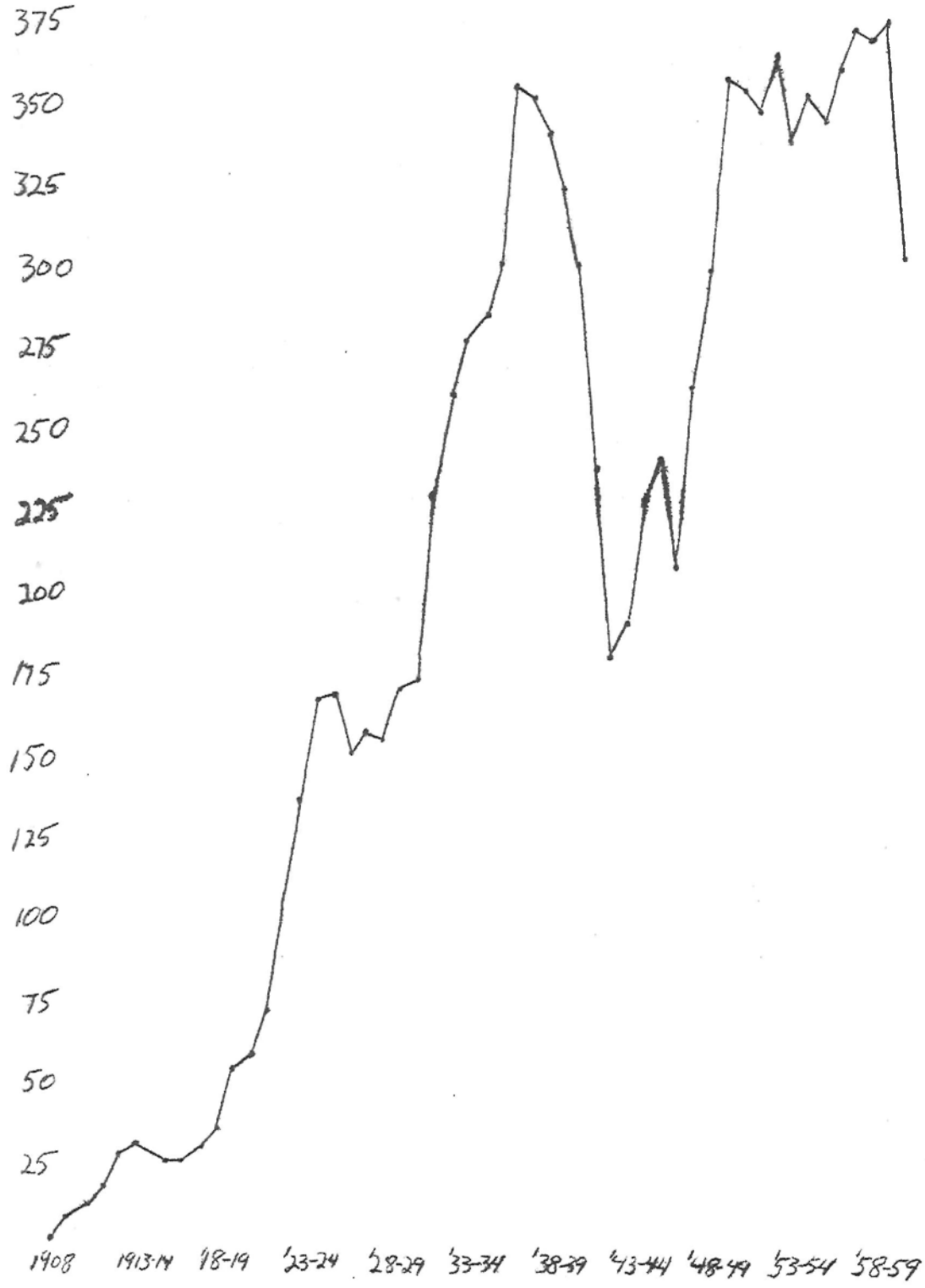
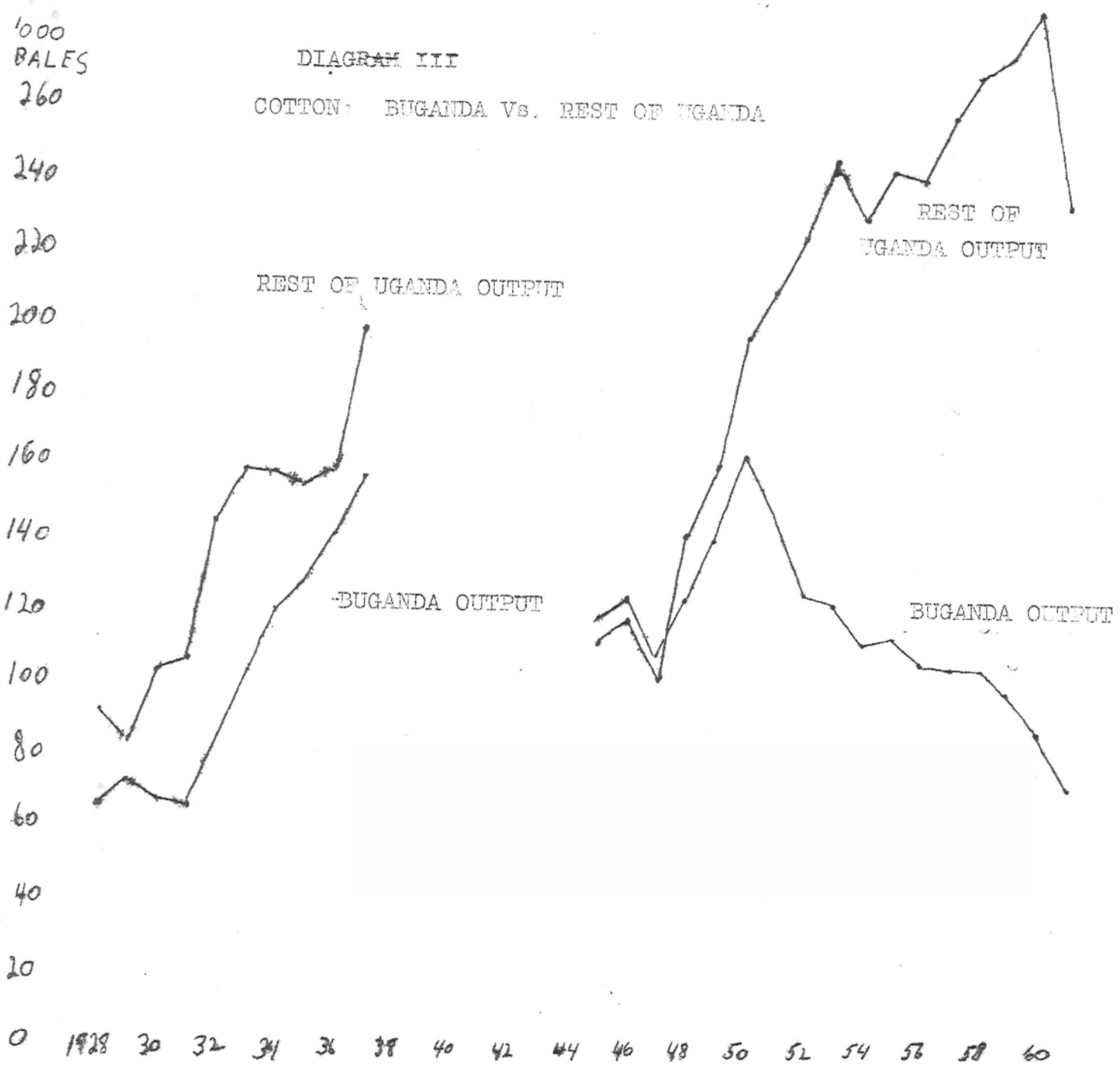


DIAGRAM III

COTTON: BUGANDA Vs. REST OF UGANDA



Three Year Moving Average

DIA GRAM IV

TREND IN REST OF UGANDA COTTON OUTPUT

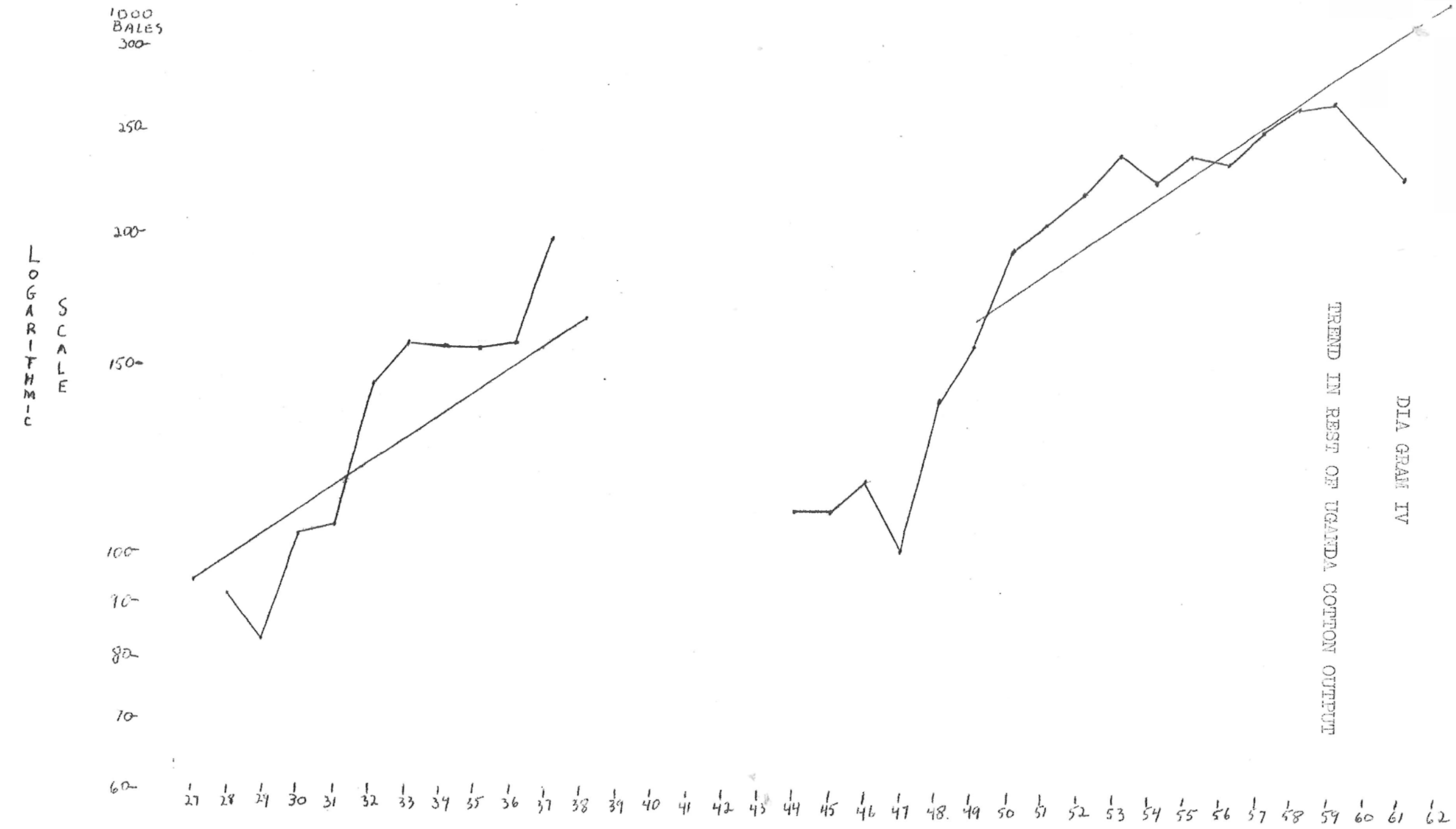
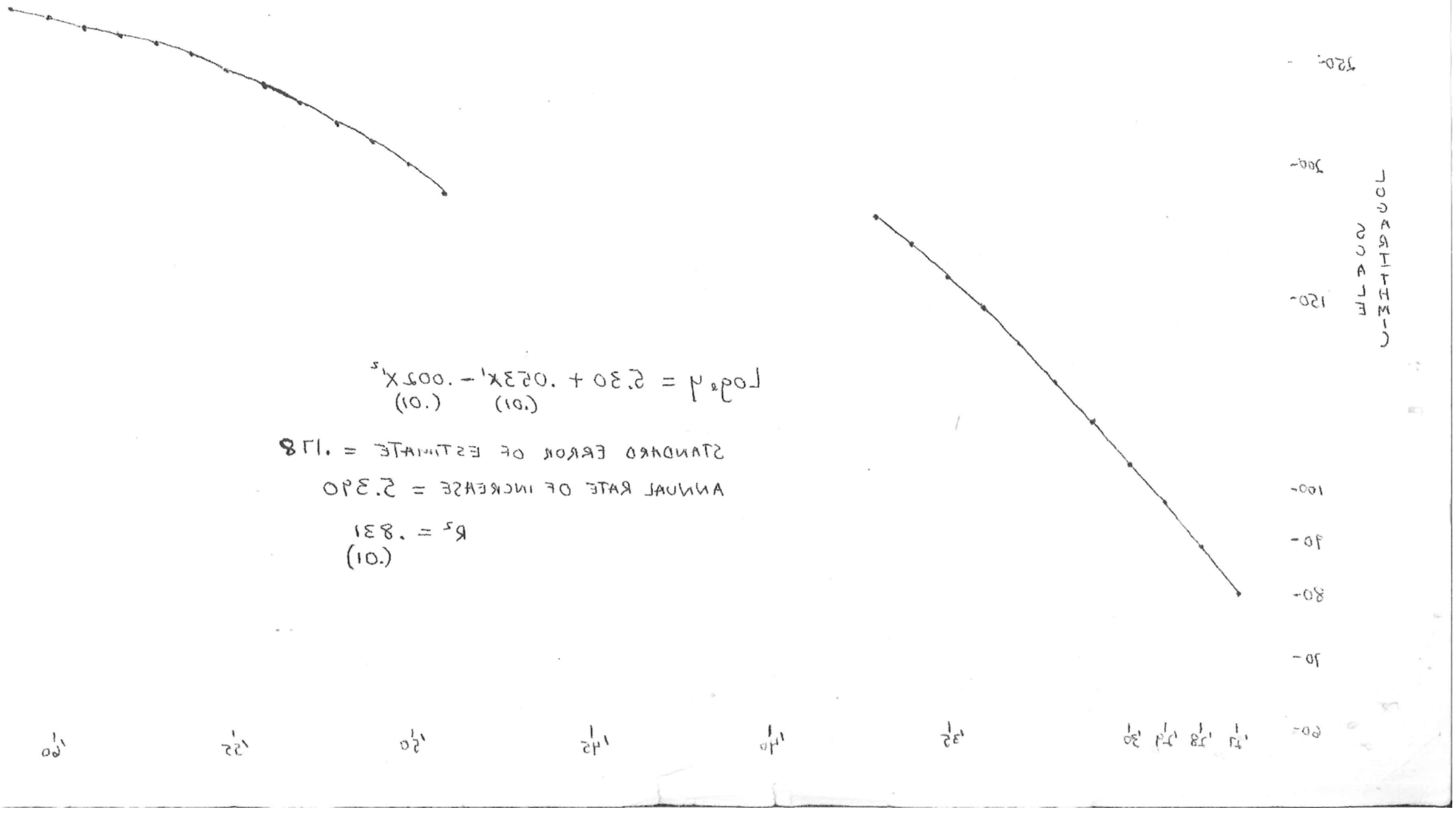


DIAGRAM V

PARABOLIC GROWTH CURVE FOR REST OF VENUDA COTTON OUTPUT



$$\log_e Y = 5.30 + .023X_1 - .007X_2$$
(.01) (.01)

STANDARD ERROR OF ESTIMATE = .118

ANNUAL RATE OF INCREASE = 5.3%

$$R_2 = .831$$
(.01)