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REPORT ON
SAMPLE SURVEY ON
CASHEW
KERALA

1971-72 to 1973-74

au of Economics and Statistics , Trivandrum.

CASHEW SURVEY

KERALA

1971-72, 1972-73 AND 1973-74

BUREAU OF ECONOMICS AND STATISTICS
Trivandrum

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INTRODUCTION

Cashew tree is a native of Brazil and its botanical name is 'Anacardium Occidentale'. The Portuguese brought this into India 400 years ago and planted them mainly to prevent soil erosion. Cashewnut has gained great commercial importance in India during the last two decades. Seasonal rains and a regular monsoon are essential for its growth. It resists drought but cannot withstand frost. Clayey soil and water logging conditions are not suitable for its cultivation.

Cashew is mainly cultivated on the west and east coasts of India. The tree is found practically in all parts of Kerala except in the highland regions. It grows well in the laterite soils of the west coast with a rainfall of over 120" but it does equally well in the sandy soils of the east coast with a rainfall of less than 35". Cashew tree grows wild together with other trees and shrubs.

Cashew crop is usually raised from the seed. The seeds are usually planted at the beginning of the south-west monsoon. Cashew seedlings do not generally thrive when transplanted. The crop is allowed to grow wild practically without any attention. Watering, manuring and other like operations are generally not done. The plant grows well even under diverse conditions of soil and climate. It grows upto a height of 20 to 25 feet in plantations. The cashew tree begins to yield from the third or fourth year. The flowering period starts by the month of November and extends upto February. The harvesting period covers usually two months between March and May. The peak harvesting season is more or less constant every year. The most desirable method of harvesting is the collection of nuts which fall from the trees and this assures a fully mature produce. It is less expensive too. There may be immature nuts also when the nuts are generally plucked from the trees by using bamboo poles with curved knives at one end. These immature nuts reduce the market value of the produce so collected.

The cashew kernel is the main product processed out

of the Cashewnuts while cashew shell liquid is the bye-product. The raw unshelled cashewnuts are processed by various methods to obtain the finished cashew kernels meant for export. The main processes involved are roasting, shelling, drying, peeling and scraping, grading and sorting and finally packing. The cashew kernel has become popular abroad as a dessert item. Being delicious and nutritive the cashew kernel has attained world wide popularity. Cashew nut shell liquid which is extracted from the shell of the cashewnut while roasting, is a versatile raw material. The liquid can be directly used as a preservative in painting boats, fishing nets etc. and this is also made use of in the preparation of insulating varnishes, typewriter rolls etc.

Nearly seventy five percent of the raw nuts required for processing in India is being imported. The local production of raw nuts is inadequate to meet the full requirements of the processing nuits. The entire produce is never harvested and marketed because of the long duration of the harvesting period and consequent wastages on account of frequent attacks by birds, animals and urchins. It is necessary that the wastages are minimised and proper arrangements made in regard to the marketing of the nuts. Steps should also be taken to expand the extent of the area under cashewnut.

Cashew kernels occupy a dominant position in the export business of this country. It is considered to be the second biggest dollar earner for the country. India used to meet nearly 90 percent of the world demand for cashew kernels. But now increasing competition is being faced from some of the east African Countries which have started commercial production of Cashew Kernels.

Reliable estimates of area and production are necessary for purposes of planning especially on the export front. It is therefore considered important to have a comprehensive study of this crop, the results of which can be used for devising ways and means for the development of the crop.

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II. DESCRIPTION OF THE SURVEY

The Directorate of Economics and Statistics, Ministry of Food, Agriculture, Community Development and Cooperation, Government of India in their letter dated 9th April, 1970 suggested to this Bureau to take steps to conduct sample surveys in consultation with the Institute of Agricultural Research Statistics (I.C.A.R) on a regular basis in order to frame reliable estimates of area under and production of cashewnut in the State. The surveys are to form part of the agricultural programmes in the State and to be treated as a State Plan Scheme. The Government of Kerala in their Order No.G.O.Rt.207/71/Plg. dated 23.7.1971 accorded sanction for the implementation of the scheme for conducting sample surveys for the collection of data on the extent of cultivation and production of cashewnut in Kerala. The sanctioned staff consisted of one Assistant Director and one Lower Division Compiler at the headquarters and seven Upper Division Investigators and twenty three Lower Division Investigators in the field.

Accordingly this Bureau initiated the conduct of three rounds of the Cashew Survey during the IV Plan Period. The duration of each round of the survey was one year. The first round of the survey was launched on 1.9.1971.

Object of the Survey:

The objects of the survey are (i) to estimate the acreage and yield rate of cashewnut and (ii) to collect information on practices followed by the cultivators.

Coverage:

Out of the 57 taluks in the State, 38 taluks were covered for the first round of the survey while in the second and third rounds the survey was conducted only in 35 taluks. The taluks selected for the survey cover about 95 percent of the area under the crop.

Sampling design:

The design adopted for selecting sample units was one of the multi-stage stratified random sampling. Cashew is

cultivated only in the low land and midland regions of the
state. During the first round of the survey, the 14 taluks
in the low land region which were important for cashew
cultivation were grouped together to form one stratum and
the remaining 24 taluks which belonged to the midland region
were grouped into three strata according to intensity of
cashew cultivation. Thus there were four strata in all
for the first round. Within the stratum census village was
the primary unit of sampling. Equal allocation of sample
villages was made among the different strata. Accordingly
for estimation of the number of trees 40 census villages
were selected at random from each stratum, during the first
round of the survey. In each selected village plot to
plot enumeration of cashewnut trees was carried out by
visiting all the survey numbers in the village. Collection
of data on yield and cultivation practices was confined
to 30 villages selected at random from among the villages
already selected for enumeration. A sample of two randomly
selected orchards was covered in each selected village for
collecting detailed information on various cultivation
practices of the crop. The actual harvested yield was
obtained from two clusters of three adjacent trees each
selected at random in each of the orchards so selected.
Since cashewnut crop was harvested a number of times and
at frequent intervals in the season, the enumerator was
directed to visit each selected orchard once in every three
or four days to observe and record data on harvested yield
of each of the selected trees on the day of visit by actual
weighment. The owner of the selected plot had also been
requested to store the produce separately for each of the
selected trees collected between two consecutive visits
of the investigator for making appropriate records at his
next visit. In the second and third rounds the sampling
design adopted during the first round was slightly modified
with a view to get district estimates. The district was

taken as the stratum and the survey was conducted in
35 taluks which are important for cashew cultivation. Census
villages were allocated among the taluks considering the
distribution of area under cashew in them. Altogether 240
census villages were selected separately for each round
through out the state for enumeration and 60 villages for
collection of data on yield and cultivation practices. Other
details remained the same as for the first round.

Organisation:

The Investigators were responsible for the plot to
plot enumeration of cashew trees in the selected villages
and the collection of data relating to yield and cultural
practices. The Statistical Inspectors were entrusted with
the selection of orchards and cashewnut trees for crop-
cutting. The field work relating to actual harvesting and weigh

weighment of the harvested and picked up nuts for each
selected tree were attended to by the Investigators. The
field work was supervised by the concerned Statistical
Inspectors and the District Statistical Officers. The Head-
quarters staff consisted of one Assistant Director and a
Compiler.

III. Results.

The results given in this chapter mainly relate to
the estimates of the number of cashew trees, area under the
crop and production of raw nuts. The results pertaining to
each round of the survey are furnished in separate tables
and comparative tables are also provided. As already men-
tioned, there is a change in the design of the survey in
the second and third rounds from that of the first round.
The first round of the survey covered thirtyeight taluks
and they were grouped into four strata. The second and
third rounds of the survey covered thirtyfive taluks and the
district was considered as the stratum so as to throw up
district-wise estimates (list of taluks attached).

Estimated number of trees: The estimates provided in the
tables relate to the area covered by the survey and not to
Kerala State as a whole. But state-wise estimates have also
been framed taking into account the estimates of the remain-
ing taluks, other than those considered for the survey, based
on the land utilisation survey conducted by this Bureau.
Here also a few taluks have been omitted since it is known
that there is practically no cashew cultivation. Table No.I
provides stratum-wise estimates of bearing, non-bearing and
the total number of cashew trees, obtained for the 1st round.
The percentage standard errors also have been worked out and
included in the table. The total number of trees is estimated
to be 312 lakhs of which 230 lakhs are bearing and 82 lakhs
non bearing. When the land utilisation survey estimates for
the remaining taluks,not covered by the survey are also
added up, the estimate of the total number of trees for the
state for the first round works out to be 325 lakhs, as shown
in table No.IV. Tables II and III provide the estimates of
the number of cashew trees in the second and third rounds
of the survey. District-wise estimates of bearing, non-
bearing and total number of cashew trees are furnished in
these two tables. The total number of trees for the second
round (72-73) works out to be 314 lakhs of which 233 lakhs
are bearing and 81 lakhs trees non-bearing. The respective
figures for the third round of the survey (73-74) are
295 lakhs, 219 lakhs and 76 lakhs. The state estimates of
the total number of cashew trees for the years 72-73 and
73-74 work out to be 334 lakhs and 320 lakhs respectively
and they are also included in table No.IV. According to the
figures for the second and third rounds, it is seen that
Cannanore district claims the highest share of the total
number of trees in the state viz.,more than 35 percent.
Malappuram district claims near about 20 percent of the total.
Trichur and Palghat districts occur next in the line while
Kottayam district records the lowest share which is less than
$\frac{1}{2}$ percent.

Area under Cashew:-   State estimates of area under cashew
crop, including the area arrived out of land utilisation survey
estimates for the remaining taluks not covered by the Cashew
survey are presented in table V of the appendix.   The area
figures for the three years 1971-72, 72-73 and 73-74 are
1.08 lakh hectares, 1.11 lakh hectares and 1.07 lakh hectares.
District-wise distribution of area under the cashew crop,
as obtained from the survey for the years 1972-73 and 73-74
is presented in tables V(a) & V(b).   The five northern
districts of the State viz. Cannanore, Kozhikode, Malappuram,
Palghat and Trichur, claim nearly 85 percent of the area
under the crop, the largest share being held by Cannanore
and Malappuram.   Observations from a few pure plots reveal
that on an average the stand per hectare is 300.

Average yield per tree.   Estimates of the average yield of
raw nuts per bearing tree and production of raw nuts for the
three rounds of the survey have been presented in tables VI,
VII, & VIII of the appendix.   District wise yield rates
are furnished for the second and third rounds of the survey.
The average yield per bearing tree for the state was estimated
at 4.88 Kgs. for the year 1971-72, 3.89 Kgs. for the year
72-73 and 3.97 Kgs. for the year 73-74.   In the year 1972-73
Trivandrum district recorded the highest average yield
per tree viz. 5.83 Kgs. closely followed by Quilon with an
yield of 5.59 Kgs.   The lowest yield viz. 2.88 Kgs. per tree
was seen recorded at Ernakulam.   But during the next year
the average yield per bearing tree for Ernakulam district
was the highest viz. 5.37 Kgs. closely followed by Trivandrum
and Quilon districts with 4.89 Kgs. and 4.48 Kgs. per tree
respectively.   This year Kozhikode has recorded the lowest
rate viz. 2.09 Kgs./tree.

Total production of raw nuts in the State.   District-wise
production of raw nuts for the years 1972-73 and 73-74
estimated for the area covered by the survey have been presented
in tables VII and VIII and the estimates for the state as

a whole for the three rounds 71-72, 72-73 and 73-74 obtained
by adding the estimates for taluks not covered by the survey,
arrived out of land utilisation surveys to the estimates for
the area covered by the survey have been presented in table
No.IX. The total production of nuts for the state for the
three years is estimated to be 115,000, 96,700 and 94,750
metric tonnes respectively. The District-wise estimates reveal
that Cannanore and Malappuram districts are the major produc-
ing districts and these districts claim nearly 67 percent of
the total production in 73-74 and nearly 59 percent in 72-73.

Age-wise distribution of trees. It is difficult to assess
the age of Cashewnut trees since the crop is not systematically
cultivated. The cultivators were not in a position to give
the year of planting and so age as entered for selected
trees should not be taken as exact. According to observations
made on trees included in the sample it is seen that nearly
90 percent come under the broad age group viz. below 30 years.
The rest (nearly 10 percent) is included in the group
'above 30 years'. 34 percent of the total number of trees
come under the age-group 4 - 10 years while the group above
10 but below 30 years claims nearly 42 percent. Nearly
14 percent are seen to be below 4 years and none of them
has started bearing. In the age group 4-10 years nearly 18
percent have not started bearing while very few are reported
to be non-bearing in the age group above 10 years but below
30 years.

Period of harvest and number of harvests. The harvesting
period of cashew trees was found to be between February and
May. The peak period of harvest is more or less constant
every year and the period usually covers two months between
March and May. There are rare cases of harvesting reported
in the early weeks of June also. More than seventy percent
of the production of nuts came from the harvests in the
months of March and April. The average number of harvests
per tree was 9. In more than fifty percent of the cases,
the number of harvests is found to be between 7 and 11.

But there are cases where the Investigators have recorded more than 20 harvests.

Cultivation practices. The cashew crop is generally raised from the seed. Small pits six to twelve inches deep are dug at a distance of 25 - 30 ft. The cashew seedlings are not generally transplanted. Watering, manuring and other cultural operations are not done generally.

Varieties: There are no district varieties of cashew trees. The trees can be broadly classified according to the colour of the apple. There are trees which bear yellow apples and there are others which bear red apples. Pørovision had been made in the schedules to indicate trees which bear fruits with mixed colours. But very few such cases have been reported. Observations reveal that the two varieties exist more or less in equal numbers. The cashew trees either grow erect or grow spreading. Erect trees are found more in the samples observed covering nearly 65 percent while the spreading trees cover only 35 percent.

Utilisation of nuts and fruits. The nuts harvested are mainly marketed while the fruits are utilised mostly for domestic consumption. Only a very small percentage, to the extent of nearly 7 percent of the nuts goes for domestic consumption. Cashew apple juice can be profitably made use of in the preparation of certain beverages, jams and different kinds of pickles. Attempts are being made in this line at a few centres in the state. A very large part of ashew apples produced is being wasted annually in the country mainly due to various problems arising in the collection, preservation and transport of the perishable fruit from scattered areas. The raw unshelled cashewnuts are processed by various methods to obtain the finished cashew kernels.

Export trade: India enjoys almost a virtual monopoly in regard to cashew kernels in the world market. The trade contributes substantially to our foreign exchange earnings.

Cashew kernel is one of the largest dollar earners of India.
It is a noteworthy feature of the cashew industry that a
large proportion of the raw nuts required for the industry
is being imported since the indigenous production of nuts is
inadequate to meet the full requirements of all the processing
units. East Africa is the main source of supply of these
raw nuts. United States of America continues to be the main
buyer of Indian cashew kernels in the world. The trade with
the U.S.S.R. is of relatively recent origin. U.K., Canada,
Australia, East Germany and other East European countries
are the other traditional buyers of our cashew kernels. Now
India is facing stiff competition in this field and that too
mainly from the producing countries in East Africa. These
producing countries of Africa are entering the field of process-
ing cashew and the Indian trade in cashew kernels and cashew
shell liquid will be seriosuly affected if indigenous produc-
tion of raw nuts,is not sufficiently increased so as to meet
the full requirements of our processing units. Large cashew
plantations on a scientific basis have to be developed with
improvementsin the methods of collection and marketing of raw
nuts.

IV. <u>Summary and conclusions.</u> Three rounds of the sample
survey to estimate the area under cashew trees and production of
cashew nuts for the years 1971-72, 1972-73 and 1973-74
are discussed above. The survey was confined to 38 taluks
in the first round and 35 taluks in the subsequent rounds.
The taluks considered for the survey cover nearly 95 percent
of the area under the crop.

According to the survey, the total number of
cashew trees was of the order of 307 lakhs out of which the
bearing trees were estimated at 227 lakhs which is nearly
74 percent of the total number of trees. State-wise estimates,
taking into account the estimates for the remaining taluks,
other than those considered for the survey, based on the land-
utilisation survey conducted by the Bureau, works out to be
327 lakhs. The area under cashew is estimated to be 1.09 lakh
hectares.

District-wise figures are furnished for the years 1972-73
and 1973-74 in the tables appended.

The average yield per bearing tree averaged
over the three years was estimated at 4.25 Kg. The annual
production for the three years was estimated at 115,000, 96,700 an
and 94,750 metric tonnes respectively. The district-wise
estimates reveal that Cannanore and Malappuram districts are
the major producing districts and these districts claim
about 60 percent of the total production.

It is seen that nearly 90 percent of the trees
come under the broad age group 'below 30 years. In the
age group 4 - 10 years nearly 18 percent have not started
bearing while very few are reported to be non-bearing in the
age group above 10 years but below 30 years. The harvesting
period of cashew trees was found to be between February and
May. The peak period of harvest covers two months between
March and May. The average number of harvests per tree was
found to be 9.

Cultural operations are very few. Watering,
manuring and other like operations are not done generally.
There are no distinct varieties of cashew trees. The trees
can be broadly classified according to the colour of the apple.
The cashew trees either grow erect or grow spreading. Erect
trees are found more in number.

The raw unshelled cashewnuts are processed by various
methods to obtain the finished cashew kernels,. The main
product is the cashew kernels, The main product is the cashew
kernel while the bye-product is the cashew shell-liquid.
India enjoys almost a virtual monopoly in regard to cashew
kernels in the world market. The trade contributes substantially,
to our foreign exchange earnings. Indigenous production of
nuts is inadequate to meet the full requirements of all the
processing units. Indian trade in cashew kernels and cashew
shell liquid will be seriously affected if indigenous production
of raw nuts is not sufficiently increased by developing large
cashew plantations on a scientific basis. The present methods
of collection and marketing of raw nuts should also be
improved.

APPENDIX I

1. List of taluks covered by the survey in 71 -72(I Round)

2. List of taluks covered by the survey in 72-73 and 73-74
(II & III Rounds)

APPENDIX II

KERALA STATE

Cashew Survey I Round 1971-72
Names of taluks covered by the Survey

Serial No.	District	Name of taluk	Serial No.	District	Name of taluk
1.	Trivandrum	Neyyattinkara Nedumangad Trivandrum Chirayinkil	6.	Palghat	Ottappalam Mannarghat
2.	Quilon	Quilon Karunagappally Pathanapuram Kunnathur Pathanamthitta Kottarakkara	7.	Malappuram	Ponnani Tirur Perinthalmanna Ernad
3.	Alleppey	Karthikappally Ambalapuzha Sherthalai Mavelikkara Chengannur	8.	Kozhikode	Kozhikode Quilandy
4.	Ernakulam	Thodupuzha Moovattupuzha Kunnathunad Alwaye Kanayannur	9.	Cannanore	Tellicherry Cannanore Taliparamba Hosdurg Kasargode
5.	Trichur	Cranganur Chowghat Mukundapuram Trichur Thalappilly			(38 taluks)

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Cashew Survey II & III Rounds

Names of taluks covered by the Survey

Sl. No.	District	Name of taluk	Sl. No.	District	Name of taluk
1.	Trivandrum	Neyyattinkara Nedumangad Chirayinkil	7.	Palghat	Palghat Ottappalam Mannarghat
2.	Quilon	Quilon Kottarakkara Kunnathur Pathanapuram	8.	Malappuram	Perinthalmanna Ponnani Tirur Ernad
3.	Alleppey	Karthikappally Mavelikkara Chengannur Sherthalai	9.	Kozhikode	Kozhikode Quilandy Badagara
4.	Kottayam	Kottayam Vaikom	10.	Cannanore	Thaliparamba Cannanore Hosdurg Kasargode
5.	Ernakulam	Muvattupuzha Kanayannur Kunnathunad Alwaye			(35 taluks)
6.	Trichur	Mukundapuram Trichur Talappilly Chowghat			

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Cashew Survey I Round 1971-72

Table No. I

Estimates of the number of Bearing, Non-bearing and total Number
of Cashew trees

Stratum No.	No. of bearing trees (Lakhs)	No. of non-bearing trees (lakhs)	Total No. of trees (lakhs)	Standard error in %	Percentage of trees in each stratum
I	27.68	9.23	36.91	3.80	11.81
II	21.77	10.48	32.25	3.18	10.32
III	48.30	17.56	65.86	14.54	21.08
IV	132.51	44.96	177.47	17.34	56.79
Total	230.26	82.23	312.49	3.05	100.00

Coverage 38 taluks.

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Cashew Survey II Round 1972-73

Table No. II

Estimates of the number of Bearing, Non-bearing and total number of Cashew trees

District	No. of bearing trees (lakhs)	No. of non-bearing trees (lakhs)	Total No. of trees (lakhs)	Standard error %	Percentage of trees to the total
Trivandrum	10.47	3.15	13.62	9.30	4.34
Quilon	8.06	3.78	11.84	7.51	3.78
Alleppey	4.08	3.27	7.35	10.50	2.33
Kottayam	0.62	0.29	0.91	13.90	0.30
Ernakulam	11.99	2.97	14.96	22.79	4.77
Trichur	23.93	9.57	33.50	6.31	10.68
Palghat	22.91	8.33	31.24	6.70	9.96
Malappuram	43.20	22.42	65.62	5.23	20.91
Kozhikode	17.43	7.17	24.60	8.90	7.84
Cannanore	90.06	20.04	110.10	3.01	35.09
Total	232.75	80.99	313.74	2.35	100.00

Coverage - 35 lakhs.

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Cashew Survey III Round 1973-74

TABLE No.III

Estimates of the number of Bearing,non-bearing and total number of Cashew trees

District	No.of bear- in trees (lakhs)	No.of non- bearing trees (lakhs)	Total No. of trees (lakhs)	Standard error %	Percentage of trees to the total
Trivandrum	10.25	5.78	16.03	26.14	5.43
Quilon	10.07	4.09	14.16	22.54	4.79
Alleppey	3.32	3.02	6.34	21.41	2.15
Kottayam	0.51	0.23	0.74	30.71	0.25
Ernakulam	9.46	2.33	11.79	7.33	3.99
Trichur	16.67	11.94	28.61	9.49	9.69
Palghat	17.26	7.30	24.56	17.64	8.31
Malappuram	42.39	11.18	53.57	8.26	18.13
Kozhikode	16.25	3.14	19.39	13.64	6.56
Cannanore	93.18	27.06	120,24	9.90	40.70
Total	219.36	76.07	295.43	5.08	100.00

Coverage 35 taluks.

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Cashew Survey I, II & III Rounds

Table No. IV

Table for Comparison of Estimates of the total number of Cashew trees.

Round No.	No. of taluks covered.	Cashew survey Est. of total number of trees (lakhs)	Percentage standard error	L.U.S. Estimates for the remaining number of taluks (lakhs)	Total No. of trees for the State (lakhs)
I	38	312.49	3.05	12.66	325.15
II	35	313.74	2.35	20.38	334.12
III	35	295.43	5.08	24.82	320.25

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Cashew Survey I, II & III Rounds

Table No. V

Estimates of area under Cashew Trees for the three years 1971-72, 72-73 and 1973-74

Year	Round No.	No.of taluks covered by Cashew survey.	Area in hectares	Total for the State (Hectares)
1971-72	I	38	104163	108383 *
1972-73	II	35	104580	111373
1973-74	III	35	98477	106750

* Includes Land Utilisation Survey estimates for the remaining taluks not covered by the Survey.

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Cashew Survey II Round 1972-73

Table No. V(a)

District-wise distribution of area under Cashew Crop during the second round of the Survey.

District	No.of Cashew trees (lakhs)	Area in hectares (000)
Trivandrum	13.62	4.54
Quilon	11.84	3.95
Alleppey	7.35	2.45
Kottayam	0.91	0.30
Ernakulam	14.96	4.99
Trichur	33.50	11.17
Palghat	31.24	10.41
Malappuram	65.62	21.87
Kozhikode	24.60	8.20
Cannanore	110.10	36.70
Total	313.74	104.58

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Cashew Survey III Round 1973-74

Table No. V(b)

District-wise distribution of area under Cashew Crop during the third round of the survey.

District	No.of Cashew trees (lakhs)	Area in hectares (000)
Trivandrum	16.03	5.34
Quilon	14.16	4.72
Alleppey	6.34	2.11
Kottayam	0.74	0.25
Ernakulam	11.79	3.93
Trichur	28.61	9.54
Palghat	24.56	8.19
Malappuram	53.57	17.86
Kozhikode	19.39	6.46
Cannanore	120.24	40.08
Total	295.43	98.48

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Cashew Survey I Round 1971-72

Table No.VI

Estimates of the average yield per bearing tree and production
of raw nuts.

Stratum No.	No.of bearing trees (lakhs)	Average yield per tree (Kgs.)	Production of raw nuts (tonnes)	Standard error in % of the average yield.	Percentage of production in stratum
I	27.68	3.01	8332	29.9	7.42
II	21.77	4.50	9796	21.3	8.72
III	48.30	4.25	20528	26.8	18.28
IV	132.51	5.56	73676	15.6	65.58
Total	230.26	4.88	112332	11.8	100.00

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Cashew Survey II Round 1972-1973

Table No.VII

Estimates of the average yield per bearing tree and production of raw nuts.

District	No.of bearing trees (lakhs)	Average yield per tree(Kg.)	Production of raw nuts (tonnes)	Standard error in % of the average yield.	Percentage of production to total
Trivandrum	10.47	5.83	6104	27.5	6.75
Quilon	8.06	5.59	4506	10.0	4.98
Alleppey	4.08	3.35	1367	28.6	1.51
Kottayam	0.62	3.55	220	32.7	0.24
Ernakulam	11.99	2.88	3453	15.6	3.82
Trichur	23.93	2.95	7059	23.1	7.80
Palghat	22.91	3.41	7812	18.8	8.64
Malappuram	43.20	3.97	17150	21.1	18.96
Kozhikode	17.43	3.88	6763	32.7	7.48
Cannanore	90.06	4.00	36024	20.3	39.82
Total	232.75	3.89	90458	9.20	100.00

KERALA STATE

Cashew Survey III Round 1973-74

Table No.VIII

Estimates of the average yield per bearing tree and production
of raw nuts

District	No.of bearing trees (lakhs)	Average yield per tree (Kgs.)	Production of raw nuts (tonnes)	Standard error in % of the average yield.	Percentage of production to the total
Trivandrum	10.25	4.89	5012	40.4	5.76
Quilon	10.07	4.48	4511	16.7	5.19
Alleppey	3.32	3.14	1042	25.8	1.20
Kottayam	0.51	2.14	109	36.3	0.13
Ernakulam	9.46	5.37	5080	24.6	5.84
Trichur	16.67	2.96	4934	34.0	5.67
Palghat	17.26	2.97	5126	18.4	5.89
Malappuram	42.39	3.98	16871	21.7	19.40
Kozhikode	16.25	2.09	3396	37.2	3.90
Cannanore	93.18	4.39	40906	37.6	47.02
Total	219.36	3.97	86987	11.7	100.00

KERALA STATE

Cashew survey I, II & III Rounds

Table No.IX

Estimates of the average yield rate and production of raw nuts
in the three rounds.

Round No.	No.of taluks covered.	No.of bearing trees (lakhs)	Average yield per tree (Kgs.)	Total production by of raw nuts (tonnes)	Total production for the State including L.U.S. Est.for the remaining taluks (tonnes)
I	38	230.26	4.88	112332	115000
II	35	232.75	3.89	90458	96700
III	35	219.36	3.97	86987	94750

KERALA STATE

Cashew survey I Round 1971-72

Table No. X

Percentage distribution of bearing and non-bearing
Cashew trees in the different strata.

Stratum No.	Bearing cashew trees	Non-bearing of cashew trees	Total
I	8.86	2.95	11.81
II	6.97	3.35	10.32
III	15.46	5.62	21.08
IV	42.40	14.39	56.79
Total	73.69	26.31	100.00

KERALA STATE
Cashew Survey II Round 1072-73
Table No. XI

Percentage distribution of bearing and non-bearing cashow trees
in the different districts

District	Bearing cashew trees	Non-bearing cashew trees	Total
Trivandrum	3.34	1.00	4.34
Quilon	2.58	1.20	3.78
Alleppey	1.29	1.04	2.33
Kottayam	0.21	0.09	0.30
Ernakulam	3.82	0.95	4.77
Trichur	7.63	3.05	10.68
Palghat	7.31	2.65	9.96
Malappuram	13.76	7.15	20.91
Kozhikode	5.55	2.29	7.84
Cannanore	28.70	6.39	35.09
Total	74.19	25.81	100.00

KERALA STATE

Cashew Survey III Round 1973-74

<u>Table No. XII</u>

Percentage distribution of bearing and non-bearing Cashew trees in the different districts.

District	Bearing Cashew trees	Non-Bearing Cashew trees	Total
Trivandrum	3.47	1.96	5.43
Quilon	3.41	1.38	4.79
Alleppey	1.13	1.02	2.15
Kottayam	0.17	0.08	0.25
Ernakulam	3.20	0.79	3.99
Trichur	5.64	4.05	9.69
Palghat	5.84	2.47	8.31
Malappuram	14.35	3.78	18.13
Kozhikode	5.50	1.06	6.56
Cannanore	31.54	9.16	40.70
Total	74.25	25.75	100.00

APPENDIX III

Estimation Procedure

1. **No. of cashew trees.** The number of bearing, non-bearing and total number of cashew trees were separately estimated for each stratum. First, the estimates were made for each selected village and the average stand per acre in each stratum calculated by the weighted average method, using the areas of the selected villages as weights. Multiplying this average stand per acre by the dryland area of the stratum, the estimate for the stratum were arrived at.

The number of bearing cashew trees in the ith stratum was estimated as $P_i = \dfrac{A_i}{\sum_{j=1}^{m_i} a_{ij}} \cdot \sum_{j=1}^{m_i} p_{ij}$ where p_{ij} = number of bearing trees in the jth selected village of the ith stratum. a_{ij} = The dry land area of the jth village of ith stratum and A_i = Total dryland area of all villages in the ith stratum.

The total number of bearing trees for all the strata is given by $P = \sum_{i=1}^{L} P_i$ where L is the total number of strata. The variance of the number of bearing trees for all the strata together was estimated as

$$V(P) = \sum_{i=1}^{L} \frac{N_i(N_i - m_i)}{m_i(m_i - 1)} \cdot \sum_{j=1}^{m_i} \left(p_{ij} - R_{m_i} a_{ij} \right)^2 \quad \text{where}$$

$$R_{m_i} = \sum_{j=1}^{m_i} p_{ij} \Big/ \sum_{j=1}^{m_i} a_{ij}$$

N_i = No. of villages in the ith stratum

n_i = No. of villages selected for enumeration in the ith stratum. Similarly, the other estimates were also worked out.

2. **Estimates of the average yield of raw nuts per bearing tree.**

From each village selected for crop cutting 2 plots each having at least 6 bearing trees were selected and from each plot 2 clusters of 3 trees each were selected for crop cutting surveys. The variance of the average yield for the State and variance of total production were also calculated using the number of bearing trees as weights. The average yield per bearing tree in the stratum was estimated as

$$\bar{Y}_i = \sum_{j=1}^{m_i} B_{ij} \cdot \bar{y}_{ij} \Big/ \sum_{j=1}^{m_i} B_{ij} \quad \text{where} \quad \bar{y}_{ij} = \text{Av. Yield of nuts from}$$

jth village of the ith stratum.

Bij = No.of bearing trees in the jth village selected for crop cutting in the ith stratum.

The average yield per bearing tree for all the strata was also estimated using the same method of procedure as

$$\bar{Y} = \sum_{i=1}^{L} B_i \cdot \bar{Y}_i \Big/ \sum_{i=1}^{L} B_i$$

Variance of $\bar{Y}_i$ was given by $Var(\bar{Y}_i) = \frac{(N_i - n_i)}{N_i \, n_i (n_i - 1)} \times \frac{1}{\left(\frac{\sum_{j=1}^{n_i} B_{ij}}{n_i}\right)^2} \cdot \sum_{j=1}^{n_i} \left(T_{ij} - Q_{n_i} B_{ij}\right)^2$

where $T_{ij} = B_{ij} \cdot \bar{Y}_{ij}$ and $Q_{n_i} = \sum_{j=1}^{n_i} T_{ij} \Big/ \sum_{j=1}^{n_i} B_{ij}$

The variance of the average yield per bearing tree for all the strata was calculated as

$$V(\bar{Y}) = \sum_{i=1}^{L} B_i^2 \cdot V(\bar{Y}_i) \Big/ \left(\sum_{i=1}^{L} B_i\right)^2$$

The total production of nuts was given by

$$T = \sum_{i=1}^{L} T_i \quad \text{where } T_i = B_i \times \bar{Y}_i$$

The variance of T_i was given by

$$V(T_i) = \bar{Y}_i^2 \, V(B_i) + B_i^2 \times V(\bar{Y}_i) \quad \text{and the variance}$$

of the total production of nuts was estimated as

$$V(T) = \sum_{i=1}^{L} V(T_i)$$

APPENDIX IV

Cashew Survey

1971-72, 72-73 and 1973-74

Instructions to field staff

1. Object of the Survey.

The objects of the survey are –

(a) To estimate the acreage and yield rate of Cashewnut in Kerala.

(b) To collect data on the cultivation of the crop.

2. Duration. The survey will be for a period of 3 years commencing from 1st September 1971. There will be three rounds of the survey, the duration of each round being one year.

3. Coverage: Out of the 57 taluks in the state 19 have negligible area under cashew. The remaining taluks account for more than 95 percent of the total area under the crop in the state and these 38 taluks will be covered by the survey.

4. Sampling design:. The design adopted for selection of sample units will be one of multi-stage random sampling. Cashew is cultivated only in the low land and mid land region of the state. The 14 taluks in the low land region which are important for cashew cultivation are grouped together to form one stratum. The remaining 24 taluks which belong to the midland region are grouped into three strata according to the intensity of cashew cultivation. Thus there will be four strata in all. Within the stratum the census village/kara will be the primary unit of sampling. The overall number of karas selected at random will be 160.

In each selected village a list of plots as per the village records will be made in form 'O'. The Investigator should then visit each and every household in the village to fill in col.7 of form 'O' and cols. 1 to 4 in form I.

During the second and third rounds of the Cashew survey, the district was taken as the stratum. The survey covers only 35 taluks which are important for cashew crop in these two rounds, instead of the 38 taluks covered in the first round. Further an overall sample of 240 villages will be selected from these taluks. The allocation of villages has been done taking into account the area under the crop in the taluks. The villages will be selected at random from the taluks.

The 30 Investigators appointed for the survey will make plot to plot enumeration in all the selected census villages. One Investigator will be in charge of the field work relating to 6-10 villages. The Investigators will work under the direct control of the Statistical Inspector and under the over all supervision of the District Statistical Officer. From among the villages allotted to each Investigator, the District Statistical Officer will select two villages at random for yield estimation. Collection of data on yield will be done from two plots from each village selected for yield estimation. In each plot two clusters each of three adjacent trees will be selected at random for crop-cutting. The selection of plots and trees for crop cutting will be done by the Statistical Inspector. The Investigator will visit the selected plots at least twice a week for collection of yield data during the season. Form 'O' prescribed for the first round of the survey has been dispensed with. The Investigator will take down the relevant details regarding all the plots in the selected villages from the village records before commencing plot to plot enumeration.

Form I: In the case of villages the area of which is less than 1000 acres, all the plots in the village will be visited by the Investigator. In case the selected village is 1000 acres or more, it will be divided into hamlets of at-least 500 acres. A hamlet will be selected at random and all the plots in the selected hamlet will be visited.

All the plots in the village (wet & Dry) will be visited by the Investigator but only the details pertaining to the dry land plots will be entered in Form I.

Plot means a plot of land with clear boundaries. This may be one survey sub-division number, may comprise of more than one survey sub-division number or may be only a portion of a survey sub-division number. In case of cashew orchards, a plot may consist of one or more survey numbers.

Items A, B, C are clear. Against D, the geographical area as ascertained from the village records will be entered. Item E, dry land area of the census village (hamlet)consists of two sub items (1) Dry land area according to village records which can be obtained from village office; sub item (2) is the actual dry land area enumerated during the field work and is the total of Col.(5) in Form I.

Columns 1, 2, 3 and 4 are clear. In col.5 the area of the dry land plot will be entered.

In column (6) write whether the plot is a cashew orchards (OR) or others (O). A cashew orchard for the purpose of this schedule will be defined as a contiguous plot of land having only cashew trees. Cultivation of seasonal crops, like Tapioca, vegetables etc. does not exclude the plot from the definition of orchard. In case in a plot of land areas can be clearly demarcated with only cashew trees, entries in cols. 5 to 14 will be filled up for the orchard and non-orchard portion separately. The trees in each plot should be counted and the number under various classifications recorded in the relevant columns. If the plot is a large cashew orchard of over 5 acres the following procedure may be adopted. The area of vacant spaces may first be estimated by pacing and omitted from the total areas of the plot. The intensity of the crop at three or four random areas of 25 cents each within the plot may be estimated by actual counting and the total number of trees in the plot estimated on this basis. In col.(12) continuous sampling serial numbers for selection of plots will be given to all the plots having at least six bearing

trees. These six trees need not be in a contiguous area. (This change from the instructions in the previous round whereonly contiguous area of having at least six bearing trees were considered for selection of plot for crop cutting).

In col.(13) number of cashew trees felled during the previous year will be entered. If there had been large scale felling of cashew trees, the reason for it may be given in the remarks columns.

Form ii. This form is meant for selection of plots for detailed study and for collecting particulars of cashew trees in these plots. The selection of plots will be done by the Statistical Inspectors.

A sample of two random plots from among those numbered in col.(12) will be selected for the purpose of collecting detailed information on the cashew trees. (All plots having at least six bearing trees are given sampling serial numbers in col.(12). The rest of the items have been retained as in the previous round and therefore no detailed instructions are not necessary for filling in this schedule.

Form iii. This form is meant for recording the selection of trees for crop cutting and also for noting some detailed information about them.

In case the bearing cashew trees are scattered in the plot and their number is below 100, they may be serially numbered starting with the tree in the S.W.corner and proceeding in a clock-wise direction. A tree will be selected using a random number and this is the key tree, of the first cluster. Select two more trees standing nearest to this key tree. These three will form the first cluster. A second random number will be used for selecting the second key tree and thereby the second cluster. The same tree should not find place in more than one cluster. Similar procedure will be used for selecting two more clusters from the second selected plot.

If the plot is large, the key tree will be located by random pacing. Take a four degited random number and convert it into two digit random numbers. To arrive at the random spot, walk straight from the south west corner of the plot in the eastern direction taking as many steps

as the first random number. From this point walk in the northern direction as many steps as the second random number. The random spot is reached as soon as the steps are covered. Select the bearing tree nearest to this spot as the key tree for the first cluster. Select the two bearing trees nearest to this key tree to form the first cluster of three trees. Similarly select a second four digit random number and select a second cluster.

Item I, II and III in the form are self explanatory.

Form iv.

This is meant to record the yield of nuts of individual trees by actual weighment. One copy of the form will be sufficient for reporting the yield of six trees in one plot. For one village two copies of form IV are required.

BUREAU OF ECONOMICS AND STATISTICS - KERALA

Sample Survey for the Estimation of Area under and yield of Cashewnut and for collection of data on its cultivation practices (1973-74).

FORM I (Facing Sheet)

Plot to plot enumeration of Cashewnut trees.

A. District
B. Taluk
C. Census Village

D. Geographical area of the census village:
E. Dryland area of the census village
  (i) According to village records
  (ii) As per form I

Date of enumera-tion.	Sl.No. Sy.No. of Dry and sub-land Dn.No.	Name of Culti-vator.	Area of the plot		Whether orchard or others.	No.of cashew trees					Young Sam-pling cashew trees No.	No.of cashew trees cut during the past one year.
			Acres	Cents		Bearing age	Non-bearing due to					
						Bear-ing		Old age	Other rea-sons	Total		
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Station:
Date:

Signature of the Enumerator:
Signature of the Supervising Officer.

SAMPLE SURVEY FOR ESTIMATION OF AREA UNDER AND YIELD OF CASHEWNUT AND FOR COLLECTION OF DATA
ON ITS CULTIVATION PRACTICES 1973-74

FORM II

Particulars of cashewnut trees in the selected plot

District: Taluk: Village:

I (a) Random No. used for the selection of the plot.

(b) Survey Sub Division No. of Plot selected and
     its sampling serial number.

II(a) No. of trees under classification by growth of tree, colour of apple and size of nut.

	Plot I	Plot II

	Plot I						Plot II					
Growth	Erect			Spreading			Erect			Spreading		
Apple	Yellow	Red	Mixed	Yellow	Red	Mixed	Yellow	Red	Mixed	Yellow	Red	Mixed

Small nut

Medium nut

Large nut

II(b) No. of trees by age.

	Plot I								Plot II							
	Below 4 years		4 to 10 years		11 to 30 years		Above 30 years		Below 4 years		4 to 10 years		11 to 30 years		Above 30 years	
	Bear-ing	Not Bearing	Bear-ing	Not Bearing	Bear-ing	Not Bearing	Bear-ing	Not Bearing	Bear-ing	Not Bearing	Bear-ing	Not Bearing	Bear-ing	Not Bearing	Bear-ing	Not Bearing

III(a) Average distance (metres) between the trees in a cluster

Plot I		Plot II	
Cluster I	Cluster II	Cluster I	Cluster II

(b) Nature and frequency of weeding done in the current year.

For young trees

For aged trees

(c) How many irrigations are given in a year and give the time of irrigation

IV. Any new seedlings planted during the last twelve months. If so how many? In what month?

V. Application of manure during the current season.

	Plot I		Plot II	
	Organic	Inorganic	Organic	Inorganic

    i. Quantity
    ii. Time of application

Plot I	Plot II

VI. (a) At what age do the trees come to bearing
(b) Time of flowering (months)
(c) Time of peak flowering
(d) Time of commencement of picking
(e) Usual interval between two pickings
(f) Total number of pickings in the current season and total period of harvest.
(g) Method of picking

Plot I				Plot II			
Bear-ing	Non-bear-ing	Young	Total	Bear-ing	Non-bear-ing	Young	Total

VII (a) Whether affected by any disease
    Yes/No
(b) If yes, mention the disease and the No. of trees affected by each
    i.
    ii.
    iii.

	Plot I			Plot II		
	Bearing	Non-bearing	Young	Total	Bearing	Non-bearing	Young	Total

VIII (a) Are the trees affected by pests or insects (yes/No)

(b) If yes, name the pests and insects with the No.of trees affected by each.

i.

ii.

iii.

(c) Plant Protection measures if any

	Plot I	Plot II

IX. Whether nuts processed or dried by the owner and if so by what method?

X. How do you propose to utilise:
   (a) Nuts
       i. Sale
       ii. Domestic consumption
   (b) Apple
       i. Sale
       ii. Domestic consumption

Station:
Date:

Signature of the enumerator:
Signature of the Supervising Officer:

SAMPLE SURVEY FOR ESTIMATION OF AREA UNDER AND YIELD OF CASHEWNUT AND FOR COLLECTION
OF DATA ON ITS CULTIVATION PRACTICES 1973-74

FORM III

Selection of Cashewnut trees from the selected plots and their particulars

District: Taluk: Village:

	Plot I	Plot II
I (a) Survey Sub division number and sampling Sl.No. of the selected plots		
(b) Area of the Plot in Acres (0.000)		
(c) Number of bearing cashewnut trees in the plot		

(d) Length and breadth of the Plot in steps
  i. Length
  ii. Breadth		

II(a) Random numbers selected for locating random cluster.
  i. Cluster I
  ii. Cluster II		

(b) Sl.No.of the key tree selected for locaing the cluster.
  i. Cluster I
  ii. Cluster 2		

Village . . . .

	Plot I						Plot 2					
	1	2	3	4	5	6	1	2	3	4	5	6

III. Particulars of cashewnut trees selected

a. i. Growth

    ii. Colour of apple

    iii. Size of the nut

b. Age in years

c. Girth at 1' above the ground level (to be measured by a tape)

d. Eye estimate of yield of nuts as considered by the cultivator or lessee.

Station:

Date:

Signature of the Enumerator:

Signature of the Supervising Officer:

Sample survey for estimation of Area under and yield of cashewnut and for collection of data on its cultivation practices 1973-74.

FORM IV

Results of harvesting of selected trees in plots or in clusters of selected trees

1. District: 2. Taluk:

3. Census village: 4. Sl.No.of the orchard and of the key tree.

   Plot: Plot -

                                      Key tree : Cluster I:

                                           Cluster II

Har-vest No. with date.	Cluster I						Cluster II					
	Tree I		Tree II		Tree III		Tree I		Tree II		Tree III	
	No. of nuts	Wgt. in Kgms.	No.of nuts	Wgt. in kgms	No.of nuts	Wgt. in kgms	No.of nuts	Wgt. in kgms	No.of nuts	Wgt. in kgms	No.of nuts	Wgt. in kgms
1	2	3	4	5	6	7	8	9	10	11	12	13
I (a) (c)												
II (a) (c)												
III (a) (c)												
IV (a) (c)												
V (a) (c)												
VI (a) (c)												
V (a) (c)												
VI (a) (c)												
VII (a) (c)												
VIII (a) (c)												
Ix (a) (c)												
X (a) (c)												
Total Yield												

(a) Yield on the date of visit (b) Total yield before the first visit
(c) Total yield between the previous visit and visit on date. Farm price per Kg. received by the Owner.

Signature of the enumerator.   Signature of Supervising officer.