A project to determine the feasibility of developing a stabilized farming system in the unirrigable uplands of the dry zone

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SUMMARY

The Yoda Ela Dry Farming Project was initiated in the Yala cultivation season of 1976 in 100 acres of typically unirrigable upland soils in the dry zone to study the feasibility of developing a stabilized farming system to replace the current chena or shifting agriculture prevalent in this region. Detailed records were kept for four seasons culminating in Maha 1977/78. Variable incomes were noted, depending on the different capability and management of the farmers participating in the project. Yet it was demonstrated that a viable system of arable farming could be established, provided animal husbandry enterprises (dairy farming) and the cultivation of semi-perennial crops (castor and papaw) are included in the farming system to provide the farmers with an income during the drought period from June to September when the cultivation of seasonal crops is not possible without irrigation.

INTRODUCTION

The total extent of available agricultural land in Sri Lanka is about six million acres. The greater part of this is found in the Dry and Intermediate Zones which receive an annual average rainfall distribution of 35-75 inches. This region has unexploited land resources which need to be developed to meet the agricultural demands of a rapidly increasing population.

Agricultural development however has been limited by a shortage of water resulting chiefly from the uneven distribution of rainfall that obtains in this region. Nearly 70 percent of the total rainfall occurs during the 3½ months from October to mid January followed by a mild rainy spell from mid March to May. June, July, August and September are relatively rainless.

As a result, farmers have not progressed much beyond the subsistence level to which they have become traditionally accustomed. They still continue to farm a few acres of irrigated rice below the "tanks" or storage reservoirs that have been constructed in the valleys, and grow other crops on the unirrigated uplands or "chenas" in a shifting system of agriculture during the rainy season.

Early investigations, commencing in the 1940s, were directed at replacing the existing cropping systems with a stabilized form of agriculture on the highland that would elevate the farmer from subsistence level to a more profitable status. Influenced by the large-scale dry farming projects that were being undertaken on a mechanised basis in India, a dry farming scheme was established at Kurundankulama in 1943 (Karunaratna 1956). Initially, 10 farmers were settled, each receiving a 10 acre allotment. This scheme was later expanded until in 1975 the land allotments were as follows:

Allotment Size	Households (No)
more than 14.1 (Ac)	
6	12
6—8	5
8.1—14	31
more than 14.1	17
Total	65

Average size of allotment was about 11 acres. The settlers were provided with farm dwellings, livestock, implements, farm tools, tractors for land preparation and back-stopping facilities by the Department of Agriculture.

The performance of this early dry farming scheme which showed an annual household income of only Rs. 4276 during 1975 from an average allotment of 11 acres (Rs. 356 per month) after 32 years was considered most unsatisfactory. That this could be attributed to a lack of fundamental research on the efficient use of available farm resources had been realised during the early life of the Kurundankulama Project. A research station was consequently established at Maha Illuppallama in 1950 to study this aspect of dry farming and derive a suitable technology to permit a smooth transition from a shifting to a settled form of agriculture on the unirrigated uplands of the dry zone. The irrigated lowlands, which were used exclusively for the production of rice, were not faced with this problem.

The identification of two distinct land classes on the highland established the base for a new cropping systems technology (Abeyratne 1956, Abeyratne and Panabokke 1953) and Panabokke (1961). The Red Brown Earths and their associates on the well drained upper slopes were found to be suitable for the cultivation of most arable food crops from October to February, while the slopes which had a tendency to be waterlogged during this season were better adapted to the cultivation of dry rice, pasture and fodder grasses. Perennials and semi-perennials like mango, papaw, castor and tur dhal were also found to perform well on the well drained upper slopes, although the susceptibility of tur dhal to pod-borer damage precluded its use in the cropping systems which were being developed.

The success of grassland farming in the poorly drained lower slopes led to an investigation in systematic dairying (Fernando 1958 and 1961) which proved that milch animals of Indian origin and European/Indian crossbreeds could be raised successfully to give about 6 pints of milk a day (average) on grass alone, and higher yields upto 10 pints a day when grass is supplemented with concentrate feeds. This finding indicated that if a mixed farming system is adopted, farmers would be able to earn a steady income from the sale of milk from June to September when arable cropping is not possible, supported by any income they could derive from perennials and semi-perennials such as mango, papaw and castor which are able to withstand the annual drought.

Research at Maha Illuppallama was also directed at improving the traditional crops cultivated on the highlands in the dry zone, and their cropping techniques, with a view to increasing yields, and reducing the age of some crops to match the rainfall periods (Abeyratne 1956). New improved varieties have been produced in green gram, black gram, cowpea, maize and chilli which are the most widely cultivated highland crops. Soybean has also, been introduced as a new crop (Fernando and Fernando 1967)

Using the new technology emanating from Maha Illuppallama, and profiting by the mistakes of the Kurundankulama Dry Farming Scheme where the high cost of mechanised tillage and too large allotments limited the profitable utilization of farm resources, a pilot project was started in 1975 on the right bank of the Yoda Ela (main irrigation channel) close to the Maha Illuppallama Research Station to determine the feasibility of developing a stabilized farming system on the unirrigable uplands of the dry zone, which could be implemented in 2.4 million acres (Abeyratna 1956) falling outside the influence of the on-going Mahaweli Diversion Program, even when it is completed. This paper traces the performance of that project.

YODA ELA DRY FARMING PROJECT

The project was located in 100 acres on the right bank of the Yoda Ela in six catchments with a natural gradient of about 3 percent. Each catchment was typical of the Dry Zone topography with Red Brown Earths (Rhodustalfs) and their associates dominating the slopes.

The jungle was cleared, the land graded and soil conservation structures provided at a total cost of Rs. 68,000. A two mile long cart road was also constructed at a cost of Rs. 4,500. Housing materials were supplied, and the farm families constructed the houses themselves at a cost of Rs. 800/- per dwelling.

Farmers were selected on the basis of experience, age, family size and landlessness. Each family was given 5 acres of which about 1/8 acre was used as a home garden allotment. Thirteen families started farming in Yala 1976 followed by 17 families in the subsequent three seasons through Maha 1976/77, Yala 1977 and Maha 1977/78, during which detailed records were maintained.

Farming System.

A mixed farming system was adopted viz. dairying and crop husbandry. The cattle were housed in cadjan sheds. Established pasture and/or surrounding shrub jungle vegetation served as the main source of food. Use of concentrate feed was limited.

The following traditional crops were included in the cropping patterns: Paddy (62-355), Maize (Thai Composite), Kurakkan (local), Green gram (MI 4), Black gram (Type 9), Cowpea (MI 35), Gingelly (MI 1) and Chilli (MI 2). Soyabean, Castor, Papaw and Tobacco were introduced by the Project Authority.

Crop Husbandry.

The total extent cropped in the four seasons under study and the cropping intensity are given below:

Season	Total Extent (ac)	Annual cropping Intensity (%)
Yala 1976	56.0	
		180
Maha 76/77	74.5	
Yala 1977	58.8	
		191
Maha 77/78	75.8	

(Excluding home gardens, bunds, drains etc.)

The cropping intensities of 180 and 191 registered at the Project were well in advance of what was observed in the nearby villages of Payindikulama and Mawathawewa viz. 117% and 107% respectively.

Minimum tillage methods of cultivation were employed in all instances i.e. use of mammoty to turn the soil and bury weeds prior to the onset of rains, except in the case of castor and papaw which were planted in holes. All crops were sown in rows manually according to Department of Agriculture recommendations, except kurakkan and gingelly which were partly broadcast and partly row-sown.

Weeding was the main plant protection operation adopted. It was also done manually. No spraying was undertaken, except in the case of one farmer in Maha 76/77 and four farmers in Maha 77/78, to control paddy stem borer. Departmental fertilizer recommendations were not enforced. Fertilizers were used mainly for paddy, tobacco, chilli and maize.

The average per acre use of labour is given in Table 1. The extents cultivated with different crops and the yield per acre are shown in Table 2.

Table 1—Seasonal Crops
Average per acre labour use in man days

Crop	*Land prep.*	*Planting*	*Thinning*	*Weed Control*	*Fert. App.*	*Pest Control*	*Harvesting*	*Total*
Paddy ...	11.5	12.0	3.8	14.0	1.0	1.0	21.0	64.3
Chilli ...	9.1	9.6	4.1	16.5	3.0	0.5	27.0	69.8
Soybean ...	9.6	4.8	2.5	14.0	1.5	—	15.0	46.4
Green gram ...	10.8	5.2	2.8	14.0	2.0	—	13.0	47.8
Cowpea ...	11.0	3.6	1.5	13.5	2.0	0.3	12.0	44.0
Black gram ...	10.0	4.0	2.0	16.0	2.0	—	12.0	46.0
Tobacco ...	8.2	11.5	3.6	17.0	2.5	0.8	14.5	58.1
Maize ...	8.5	7.6	2.5	12.5	3.5	—	10.0	44.6
Kurakkan ...	10.5	2.0	3.2	13.5	1.2	—	13.5	43.9

	Establishment	*Management*	*Harvesting. etc*	*Total*
Castor ...	16.0	12.0	93.0	121.8
Papaw ...	18.0	13.0	60.0	91.0

Table 2—Extent in acres and average yield per acre

Crop	*Yala 76*		*Maha 76/77*		*Yala 77*		*Maha 77/78*	
	Extent	*Y/ac.*	*Extent*	*Y/ac.*	*Extent*	*Y/ac*	*Extent*	*Y/ac.*
Paddy ...	—	—	13.00	48.0 bu	—	—	16.00	35.5 bu
Maize ...	—	—	5.00	9.5 bu	—	—	0.50	—
Kurakkan ...	—	—	3.25	9.1 bu	—	—	—	—
Gingelly ...	26.25	1 2 bu	—	—	11.00	3.4 bu	—	—
Soybean ...	—	—	4.25	640.0 lb	—	—	9.50	502.0 lb
Green Gram ...	8.75	—	6.25	491.0 lb	14.00	394.0 lb	4.25	388.0 lb
Black gram ...	1.00	—	2.00	438.0 lb	0.75	250.0 lb	0.50	—
Cowpea ...	8.25	—	6.00	577.0 lb	7.75	318.0 lb	3.50	403.0 lb
Chilli ...	—	—	12.45	148.0 lb	—	—	—	203.0 lb
Tobacco ...	—	—	—	696.0 lb	—	—	—	—
Castor ...		7.00	616.0 lb	7.00 lb	59.0 lb			
Papaw ...		6.80	593.0 lb	6.80 lb	49.0 lb			

The per acre yields of seasonal crops showed a high variation for different farmers in a single season. This variation may be attributed to differences in planting times and management standards.

Dairy Husbandry

Milch cattle were sold to the farmers at government rates by the Project Authority — their values to be recovered in instalments. The total number of cow equivalents during 1976/77 and 1977/78 was 27.5 and 19.2 respectively. The difference in number during the two consecutive years is explained by the fact that after the first accounting year, some farmers returned their cows to the Project Authority as being unthrifty or infertile. The average man days for pasture and cattle management are given below:—

	Establishment	Management	Milking	Total
Pasture	14	4	23	41
Dairy	12	48	90	151

Average milk production per farm family was 2128 and 743 pints in 1976/77 and 1977/78 respectively.

Return to Family.

Annual Gross Farm Income Farming systems at the project varied considerably among farm families during each year and from year to year. Average Annual Gross Farm Income during the Farm Record Accounting Years (FRAY) 1976/77 and 1977/78 were Rs. 11,465.00 and Rs. 6,518.00 respectively (estimated at farm-gate prices during 1977/78). Distribution of annual gross farm income is given in Table 3.

Table 3:...Distribution of Annual Gross-Farm Income per Farm Family

Annual gross farm income classes (Rupees)	Percentage of farmers during FRAY 76/77	Percentage of farmers during FRAY 77/78
4000— 6000	0	60
6000— 8000	24	11
8000—10000	15	24
10000—12000	15	0
12000—14000	32	5
14000—16000	7	—
16000—18000	0	—
18000—20000	7	—

During FRAY 1976/77:

(a) Average annual gross-farm income per farm family — Rs. 11,465.00

(b) Highest annual gross-farm income per farm family — Rs. 19,829.00

(c) Lowest annual gross-farm income per farm family — Rs. 6,282.00

During FRAY 1977/78:

(a) Average annual gross-farm income per farm family — Rs. 6,518.00

(b) Highest annual gross-farm income per farm family — Rs. 12,286.00

(c) Lowest annual gross-farm income per farm family — Rs. 4,078.00

Annual Gross Farm Income from Seasonal Crops.

All the farmers during the farm record accounting year 1976/77 and 1977/78 cultivated seasonal crops, and average annual gross farm incomes were Rs. 7,600.95 and Rs. 4,912.41 during 1976/77 and 1977/78 respectively. Distribution of annual gross farm incomes from seasonal crops is shown in Table 4.

Table 4: Distribution of Gross-farm Income from Seasonal Crops

Annual gross farm income classes (Rupees)	Percentage of farmers during FRAY 77/78	Percentage of farmers during FRAY 76/77
2000— 3000	0.0	0.0
3000— 4000	7.5	11.0
4000— 5000	23.5	54.0
5000— 6000	0.0	11.0
6000— 7000	0.0	18.0
7000— 8000	7.5	6.0
8000— 9000	39.0	—
9000—10000	7.5	—
10000—11000	7.5	—
11000—12000	0.0	—
12000—13000	7.5	—

Annual Gross-Farm Income from Dairy Husbandry.

Ninety two percent of the farmers during FRAY 1976/77 and 48% of farmers during the subsequent year resorted to dairy husbandry. The annual gross farm incomes from milk production are given in Table 5.

Table 5: Distribution of Gross Farm Income from Dairy Husbandry

Annual gross farm income classes (Rupees)	Percentage of farmers during FRAY 76/77	Percentage of farmers during FRAY 77/78
0— 500	16.5	25.0
500—1000	0.0	37.0
1000—1500	16.5	13.0
1500—2000	0.0	13.0
2000—2500	8.5	0.0
2500—3000	17.0	0.0
3000—3500	16.5	0.0
3500—4000	0.0	12.0
4000—4500	16.5	0.0
4500—5000	0.0	0.0
5000—5500	0.0	0.0
5500—6000	8.5	0.0

During FRAY 1976/77:

(a) Average annual gross-farm income from milk production among those farmers who had dairy cattle = Rs. 2,775.25

(b) Average annual gross-farm income from milk production among the total number of farmers in the project = Rs. 2,517.46

During FRAY 1977/78:

(a) Average annual gross farm income from milk production among those farmers who had dairy cattles = Rs. 1,177.84

(b) Average annual gross-farm income from milk production among the total number of farmers in the project = Rs. 554.28

Annual Gross Farm Income from Perennial Crops.

Seventy two percent of the farmers during FRAY 1977/78 and 54 percent of the farmers during FRAY 1977/78 established perennial crops like castor and papaw on the given land allotments. Returns from these two crops varied considerably among farmers as shown in Table 6.

Table 6: Distribution of Annual Gross Farm Income per Farm Family from Perennial Crops.

Annual gross farm income classes (Rupees)	Percentage of farmers during FRAY 76/77	Percentage of farmers during FRAY 77/78
500—1000	0.0	34.0
1000—1500	22.0	22.0
1500—2000	34.0	22.0
2000—2500	22.0	22.0
2500—3000	22.0	0.0

During FRAY 1976/77:

(a) Average annual gross farm income from perennial crops among those farmers who cultivated the same
= Rs. 1,899.61

(b) Average annual gross farm income from perennial crops among the total number of farmers in the project
= Rs. 1,315.11

During FRAY 1977/78:

(a) Average annual gross farm income from perennial crops among those farmers who cultivated the same
= Rs. 1,509.20

(b) Average annual gross farm income from perennial crops among the total number of farmers in the project
= Rs. 799.00

Total Farm Expenditure

Farmers encountered farm costs mainly from cash inputs as well as interest and depreciation. Average annual total farm expenditure was Rs. 1,341.00 and Rs. 422.20 during the Farm Record Accounting Years 1976/77 and 1977/78 respectively. Distribution of annual total farm expenditure is given in Table 7.

Table 7: Distribution of Annual Total Farm Expenditures

Annual Total Farm expenditure classes (Rupees)	Percentage of farmers during FRAY 76/77	Percentage of farmers during FRAY 77/78
0— 250	0.0	18.0
250— 500	7.0	60.0
500— 750	0.0	12.0
750—1000	24.0	5.0
1000—1250	40.0	5.0
1250—1500	0.0	—
1500—1750	0.0	—
1750—2000	15.0	—
2000—2250	7.0	—
2250—2500	0.0	—
2500—2750	0.0	—
2750—3000	7.0	—

During FRAY 1976/77:

(a) Average annual total farm expenditures = Rs. 1,341.00
(b) Highest annual total farm expenditures = Rs. 3,076.00
(c) Lowest annual total farm expenditures = Rs. 353.00

During FRAY 1977/78:

(a) Average annual total farm expenditures = Rs. 477.00
(b) Highest annual total farm expenditures = Rs. 1,076.00
(c) Lowest annual total farm expenditures = Rs. 229.00

Farm Family Earnings

Annual Farm Family Earnings: Average annual farm family earnings for the FRAY 1976/77 were estimated at Rs. 10,092.00 while the highest and lowest figures were Rs. 16,753.00 and Rs. 5,274.00 respectively. Average farm family earnings during 1977/78 were Rs. 6,100.00 while Rs. 11,210.00 and Rs. 3,614.00 were the highest and the lowest farm earnings respectively.

Table 8: Distribution of Annual Farm Family Earnings.

Annual farm family earning classes (Rupees)	Percentage of farmers during FRAY 76/77	Percentage of farmers during FRAY 77/78
3000— 5000	0.0	48.0
5000— 7000	32.0	18.0
7000— 9000	7.0	24.0
9000—11000	24.0	5.0
11000—13000	15.0	5.0
13000—15000	15.0	0.0
15000—17000	7.0	0.0

During FRAY 1976/77:

(a) Average monthly earnings of farm families = Rs. 841.00
(b) Highest monthly earnings of farm families = Rs. 1,396.00
(c) Lowest monthly earnings of farm families = Rs. 439.00

and during FRAY 1977/78:

(a) Average monthly earnings of farm families = Rs. 508.00
(b) Highest monthly earnings of farm families = Rs. 934.00
(c) Lowest monthly earnings of farm families = Rs. 301.00

Household Expenditure

Annual: Average annual household expenditures during 1976/77 and 1977/78 were Rs. 4,706.00 and Rs. 4,538.00 respectively. Distribution is given in Table 9.

Table 9: Distribution of Annual Household Expenditures of Farm Families.

Annual household expenditure classes (Rupees)	Percentage of farmers during FRAY 76/77	Percentage of farmers during FRAY 77/78
3000—4000	33.0	31.0
4000—5000	25.0	37.0
5000—6000	25.0	25.0
6000—7000	17.0	7.0

Monthly: Analysis of monthly household expenditure patterns revealed that during FRAY 1976/77:

(a) Average monthly household expenditure = Rs. 392.00
(b) Highest monthly household expenditure = Rs. 503.00
(c) Lowest monthly household expenditure = Rs. 267.00

and during the FRAY 1977/78:

(a) Average monthly household expenditure = Rs. 378.00
(b) Highest monthly household expenditure = Rs. 560.00
(c) Lowest monthly household expenditure = Rs. 260.00

Farm Savings.

Annual household expenditures were substracted from the annual farm family earnings of each household in order to get the farm savings. Savings during FRAY 1976/77:

(a)	Average annual farm savings	= Rs.	5,386.00
(b)	Highest annual farm savings	= Rs.	7,253.00
(c)	Lowest annual farm savings	= Rs.	1,554.00

and during the FRAY 1977/78:

(a)	Average annual farm savings	= Rs.	1,562.00
(b)	Highest annual farm savings	= Rs.	3,541.00
(c)	Lowest annual farm savings	= Rs.	153.00

DISCUSSION OF RESULTS

The wide variation in the average gross family income of the Yoda Ela Project farmers in FRAY 1976/77 and FRAY 1977/78: Rs. 11,465 and Rs. 6,518 respectively, is a reflection of the differential rainfall experienced during these two years. Although the quantum of rainfall during the Maha season does not show wide variations, the pattern of distribution is often erratic and variable, causing crop losses and a reduction in the milk yield of dairy cattle largely dependent on green fodder.

During the good year 1976/77 and the bad year 1977/78 the average monthly income from the Yoda Ela Project farmers on a 5 acre allotment each was Rs. 841 and Rs. 508 respectively — an average of Rs. 675 for both years. In comparison, their counterparts in the Kurundankulama Dry Farming Scheme earned at an average monthly income of only Rs. 356 from an average family holding of 11 acres in 1975. Even allowing for higher prices in the following years, it is clear that the Yoda Ela Project farmers have increased their earning capacity substantially by the more efficient use of available resources in a smaller and more manageable allotment.

This increase in earning capacity may be attributed not only to the use of high-yielding crop cultivars and their better management during the arable cropping seasons, but also to the inclusion of dairying and the cultivation of semi-perennials, which are able to provide the farmer with a steady income during the off-season. This becomes apparent from the average gross annual income of farmers having milch cattle and semi-perennial crops in comparison to the overall average annual income of all farmers including those who do not have these additional sources of income.

For instance, in 1976/77 (FRAY) 92 percent of the farmers had dairy cattle: in 1977/78 only 48 percent. The average gross annual income for milk production from farmers having dairy cattle was Rs. 2,775 and Rs. 1,177 respectively, as against Rs. 1517 and Rs. 554 for milk production from the total number of farmers in the project.

Similarly, the average gross income from semi-perennial crops from among those farmers who cultivated them was Rs. 1,899 and Rs. 1,509 for 1976/77 and 1977/78 respectively as against Rs. 1,315 and Rs. 799 from perennial crops over the total number of farmers in the project.

CONCLUSION

The Yoda Ela Project has demonstrated that a reasonably profitable system of stabilised highland farming can be operated on the unirrigated Red Brown Earths and their drainage associates in the dry zone, which are presently cultivated as "chenas" in a shifting system of agriculture. Arable crops such as maize, kurakkan, chilli, green gram, black gram, cowpea and gingelly can be grown successfully, but in order to offset crop losses that can occur due to the erratic rainfall distribution pattern obtaining in the first season, and to provide the farmers with an income during the drought from June to September when no arable crops can be cultivated, it is very necessary to adopt a mixed farming system which includes dairying and the cultivation of semi-perennial money crops like castor and papaw.

It is pertinent to note however that the results of the Yoda Ela Project were achieved under the strict supervision of the staff of the Maha Illuppallama Research Station, who were responsible for the necessary technical advice, and were also instrumental in assisting the farmers to obtain the requisite inputs in time and to market their produce. The success of rainfed farming in the dry zone is therefore ultimately linked with efficient technological back-stopping and marketing services.

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